PTEMBER 1960 VOLUME 9 . NUMBER 9

Battelle Technical Review

IN THIS ISSUE: The Critical Assembly—A Nuclear Analog

VIGNETTE

JOHN W. MURDOCK

"Selecting desired information from the flood of materials now issuing from presses throughout the globe is becoming increasingly difficult for the information user", states John W. Murdock. "Methods of disseminating and retrieving scientific information designed to help cope with the information-selection problem sometimes seem, instead, to be adding to the users' difficulties. It is increasingly apparent that the solution of the problem lies in the direction of studying each user's needs first and then developing information processes that will meet those needs."

The various philosophies, theories, and concepts relating to scientific information are of deep import to John. He has carried on a continuing study of the techniques and possible uses of machines in information handling and of the impact of linguistics, semantics, and information theory on various information problems. Finding better methods of identifying scientific literature with given objectives is an unremitting interest. He is greatly concerned about the problem of the occasional user of information services. "Even those who have insufficient time to learn techniques of literature searching", he declares, "should have no trouble in getting the information they need."

The research of information problems has been John's overriding interest during his years at Battelle and has led to increasing responsibilities for him in the management of information services and research as well as in the direction of the Institute's library.

His main concern has been the practical aspects of the use of scientific information. He has had an important role in the development of large information centers able to service fifty or more users simultaneously. Along with other staff members, he made major contributions to the planning and establishment of the Titanium Metallurgical Laboratory which is now expanded into the Defense Metals Information Center. John also had a role in the organization of the Radiation Effects Information Center. For the last eight years, in addition to other duties, he has served almost continuously as an advisor to government agencies on information problems.

Currently, John is associated with efforts to enable industry to benefit from the vast research already performed for governmental agencies. A vital factor in more effective information services for industry, he believes, is knowledge of the whole information complex existing in the United States. At present, he is helping to guide a study that encompasses all U. S. information centers for the National Science Foundation.

A graduate of Marshall College with a B.S. in physics, John joined the Battelle staff after studies at Iowa State University that led to an M.S. in physics. He relates his first interest in information problems to experiences associated with the preparation of some of the first wartime radar manuals for the Signal Corps.

With three sons and a daughter, John finds no end of projects to keep him busy at home. He and his wife, Helen, along with the younger members of the family enjoy frequent camping trips. John is active in scouting and with Helen joins in many church activities. But he is mostly on his own in remodeling work now under way on their home.

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Preparing the films from specially compounded copolymers. Once formed, the films are measured for thickness and their crystallinity is studied. Then a specimen is prepared for evaluation in the Dow Cell.

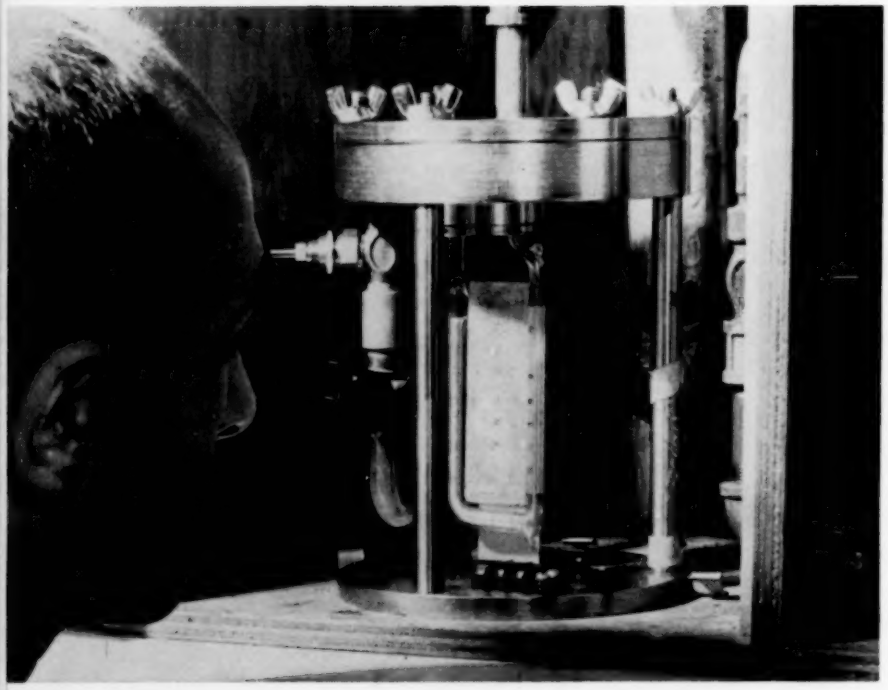
GAS PERMEABILITY OF PLASTIC FILMS

One of the little understood properties of plastic films is their permeability to gases. Studies are currently being conducted at Battelle to correlate such permeability with the structures of films.

Manfred Luttinger reports that factors being investigated include the composition of the polymers used in the films, the molecular weight and molecular-weight distribution of the polymers, and their crystallinity.

The research began with varied copolymers of vinylidene chloride and acrylonitrile and has since led to other film-forming materials. Steps in the research include making and purifying the copolymers, preparing the films (photo above), determining their crystallinity, and then measuring their permeability in a Dow Cell by standard ASTM procedures (photo left below).

Preliminary results of the study suggest that permeability appears to be affected by crystallinity, polarity, and the regularity of the polymerization. In the most recently completed work, surprisingly good gas-barrier properties have been found with polymers previously unknown for this property.



The specimen film, fastened in the section under the wing nuts, is evaluated for gas permeability in the Dow Cell. The tubing below the film is first evacuated, then gas under pressure—oxygen, nitrogen, or carbon dioxide—is introduced above the film. Permeability is determined by the displacement of the mercury column (which the chemist is reading) in relation to time.

1. *Operations of the critical reactor laboratory are observed and controlled from this panel. All controls of the mocked-up reactors and all instrumentation required for conducting reactor studies are centered here. There are no persons in the reactor areas when studies are in progress.*

The Critical Assembly--A Nuclear Analog

By simulating a reactor design in the critical assembly laboratory, physicists can rapidly and economically evaluate factors important to the reactor's operation.

by JOEL W. CHASTAIN, JR.

IN PRINCIPLE, IT SEEMS THAT the reactor physicist, with the data available to him, should be able to calculate all the characteristics of a reactor in detail. In practice, one finds that the mechanics of neutron motion and interaction with nuclei is so very complex, that rigorous theoretical treatments have not been derived or cannot be solved. Consequently, physicists have had to content themselves with development of approximate theories and their simplification to a form that can be solved mathematically. These simplified approximate theories, however, cannot give uniformly accurate results when applied to many different situations.

In most reactor design problems, an experimental program is conducted in conjunction with calculations to provide data with which to normalize the theoretical procedures. The initial conditions for the experiment are determined by preliminary calculations. Based on the results of the experiment, parameters in the theory can be adjusted, if necessary, to make theory agree with experiment. The theory can then be used with more confiidence to interpolate or extrapolate to conditions not specifically covered in the experiments. Finally, new theoretical results may be used to specify conditions for further experiments. The process can then be repeated in a search for an optimum design.

The experimental program usually entails the use of a critical assembly, the most effective means for obtaining accurate physics data. A critical assembly is a nuclear mock-up or simulation, in full scale, of the geometry and materials of the reactor core and reflector. The name derives from the fact that the assembly of fuel and other core components can attain a critical condition, i.e., can attain a self-sustaining

chain reaction. Since the amount, type, and arrangement of materials is the same as in the planned prototype, when the system is critical, factors such as flux and power distributions are identical to those initially existing in the prototype reactor. Consequently, the critical assembly is an effective analog device from which physics data can be obtained.

The fissioning rate, the rate at which the chain proceeds, can be adjusted to maintain the mock-up critical at a very low power level, say one watt or less. Since the intensity of the gamma and neutron fluxes is proportional to the power, the radiation level is quite low and requires relatively little shielding. Furthermore, at the low heat generation rate, heat removal is not a problem and, in general, forced circulation is not required. Most critical experiments are conducted close to room temperature which, along with the low heat flux, means that specifications on materials, methods of assembly, and dimensional tolerances can be relaxed. All these factors help to reduce costs and make the experiment much less expensive than use of the prototype reactor for the same purpose.

In designing a critical assembly, one must reach some compromise between extreme flexibility and exact duplication of the protoype. Considerable flexibility to permit variations in loading and configuration of core and reflector is essential in the early stages of a program. On the other hand, the system must simulate the reactor rather closely or the data will be of limited value. Either extreme, complete flexibility or exact duplication, is expensive. Consequently, the designer must evaluate the worth of specific data or, possibly, improved accuracy against the cost required to produce the information. Frequently, the cost can be kept low by substituting a material that has nuclear characteristics similar to a material in the prototype, but which is cheaper, more easily obtained, or more easily handled. For instance, aluminum strips are often used to simulate a rectangular coolant channel filled with molten sodium. Very thin strips of highly enriched uranium can be used with metal tubes or plates to mock up fuel elements.

Specific Uses for Critical Assemblies

Although all critical assemblies are essentially the same, regardless of their use, several specific uses are generally recognized: (1) mock-ups of systems to obtain specific reactor design information, (2) assemblies to provide basic physics data, (3) studies of nuclear weapons, and (4) investigations of fuel storage and shipping problems.

Most critical assemblies are used for reactor design. In these experiments, the preliminary design of the prototype reactor is simulated rather carefully, perhaps including the materials used to control the fission rate, e.g., control blades. Parameters such as core configuration and fuel loading can be varied, but basically the experimenter obtains specific information for use by the reactor physicist and engineer in designing the power reactor.

The success of most calculational techniques depends on the proper choice of certain interaction parameters. The proper values for these parameters can be obtained best from "pure geometry" or "clean" assemblies. Such assemblies do not mock up a specific reactor; rather they are idealized assemblies of moderator, fuel, and structural materials operated at critical conditions with all control blades removed from the core to produce simple geometries that can be attacked analytically. Such assemblies must be reproducible and have considerable flexibility.

Studies on nuclear weapons are concerned with supercritical assemblies consisting almost entirely of fuel. The lifetime of a neutron in these criticals is very short, and most of the investigation centers around the kinetic behavior of the system.

Frequently, critical experiments have been operated to set safe limits for storing and shipping fuel material or elements. Other operations such as isotope separation, chemical reprocessing of fuel, and fabrication of fuel elements require information from critical assemblies to insure that the fuel is handled in sufficiently small batches so that a chain reaction is not possible. These experiments relate to the size and shape of safe storage and shipping containers for solutions of uranium salts and the lattice spacing for safe

The author has participated in and guided studies of a number of important reactor concepts and is currently engaged in experiments on the Variable Moderator Reactor and the Army's First Mobile Low-Power Reactor. He has been responsible for numerous studies in radiation physics and research on the effectiveness of shielding materials, which have been conducted in the research reactor. Chastain and his colleagues have also investigated other reactor-physics, heat-transfer, thermal-stress, and reactor-core-design problems. Among his other activities, the author shares important duties in the management of Battelle's Nuclear Research Center.

storage of various size solid fuel elements under all conditions.

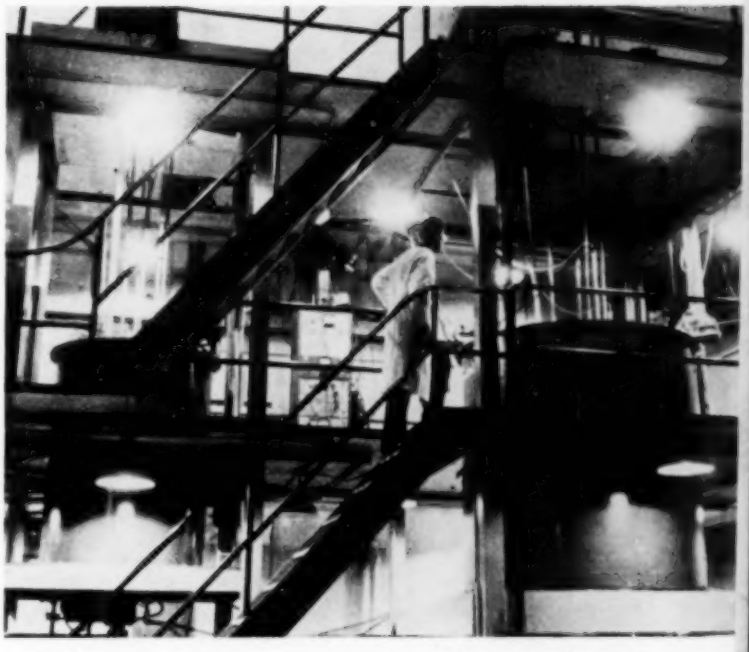
In the following sections, the statements refer to the reactor design or development assembly although most of the remarks are essentially true for the other assemblies.

Experimental Objectives

The critical assembly serves primarily as a method of obtaining information on nuclear performance. The experiments attempt to optimize the design from a physics standpoint, realizing that in the final design metallurgical and heat-removal criteria must be considered. In seeking an optimum design, the experimenter typically has available some variation in the following parameters: (1) quantity and enrichment of fuel, (2) ratio of moderating material (water, beryllium, or graphite used to moderate or slow down fast neutrons) to fuel, (3) dimensions of the reactor core, (4) material, thickness, and configuration of the reflector, (5) spacing and geometrical arrangement of fuel elements, and (6) materials and dimensions of structural components. Working with these variables and within the limits imposed by materials and heat transfer, the assembly is utilized to yield specific data on (1) fuel enrichment, quantity, and arrangement, (2) size of core, (3) power and flux distributions, (4) control-rod worth, (5) effect of adding fuel, structural material, etc., and (6) temperature coefficients and other basic physics parameters.

In the initial phase of the program, the mass of fuel required to make the assembly critical in the clean condition (with no fission products) is determined by a stepwise addition of fuel elements to the core in an arrangement specified by initial calculations. Various fuel-element spacings and distributions of fuel within an element may be tried in an attempt to lower the fuel requirements or to obtain a more advantageous arrangement. Power and neutron flux distributions are determined by measuring the neutron-induced radioactivity of foils placed in the assembly. Based on these measurements further changes in fuel arrangement or moderator-to-fuel ratio may be desirable to flatten the power distribution. With flattened or uniform power production the maximum power can be removed from a given core with a uniformly high outlet coolant temperature from all coolant channels.

An important parameter, the infinite multiplication factor, is determined by measuring fissions, neutron captures, and flux patterns in a typical unit cell. This factor is important since, to maintain a just-critical condition, the effective multiplication factor must be equal to 1; the infinite multiplication factor is the value of the multiplication factor for a specific core composition if it were infinite in size and, hence, no neutrons were lost from the reaction due to leakage from the system. By making changes in the dimensions of the core, the migration area, the distance a neutron travels from its birth as a fast neutron until it is absorbed, is measured. The two components of the migration, the slowing down area and the diffusion area, are used in most calculational methods.



2. *Multi-level stand for critical reactor studies of liquid-moderated reactor designs. Reactor-core tanks, in which fuel elements are placed, are located on the middle or working level. Electromagnets and drive units for holding and controlling the control rods are located on the top level. On the lowest level are the tanks for storing liquids used as moderators and reflectors, which are pumped into the core tanks as needed.*

Adding a reflector, a material which scatters neutrons back into the core, can reduce the size of the core appreciably, thus lowering the fuel requirements. The "reflector saving" is the term applied to the difference in size between the bare core and the reduced core plus reflector. The reflector savings for various materials, configurations, and thicknesses can be measured by analyzing axial and radial neutron flux distributions.

Having established an initial optimum design, the experimenter turns his attention to measuring changes in the effective multiplication factor caused by adding control rods, extra fuel, structural materials, and variations in temperature of the moderator and other core components. Generally, the various materials to be investigated are added in varying amounts and in different positions in the core. The system is then brought

to the critical condition and the reactivity worth, which is proportional to the change in the multiplication factor, is measured. The reactivity worth can be ascertained by observing the change in position of a calibrated control rod caused by the item under study. Temperature effects can be investigated by varying the assembly temperature over a limited range or by substituting materials with lower density. For example, furfuryl alcohol at room temperature has a hydrogen density similar to water at elevated temperatures. Consequently, it is frequently used to simulate hot water or boiling water with uniformly distributed voids.

Usually the critical assembly is controlled by absorbing rods or blades which are not a part of the prototype design. When the assembly is operated, these rods are generally almost completely withdrawn. The prototype control rods are mocked up by rods which cannot be driven remotely but can be moved manually. The critical assembly rods can be calibrated against the positive reactivity worth of adding fuel. The prototype rods are then loaded into the assembly individually or in symmetric groups and criticality restored after each addition by adding fuel. The effectiveness or worth of the reactor rods can be ascertained by relating the fuel addition back to the calibrated assembly rods.

3. Hexagonal fuel elements assembled in a reactor-core tank. Fuel in the form of cylindrical pellets is inserted in the aluminum tubes. During operation, water between the hexagonal cans serves as moderator, while the region around the tubes is filled with a liquid that simulates boiling water—the coolant. Data are taken from wires and strips placed about the core. They are activated by neutrons when the core is critical; later their radiation activity is used to give a picture of the power distribution in the core.

Critical Assembly Equipment

For critical assembly purposes most reactor systems can be categorized as liquid-moderated, solid-moderated, or solution reactors. The first two categories are by far the most common.

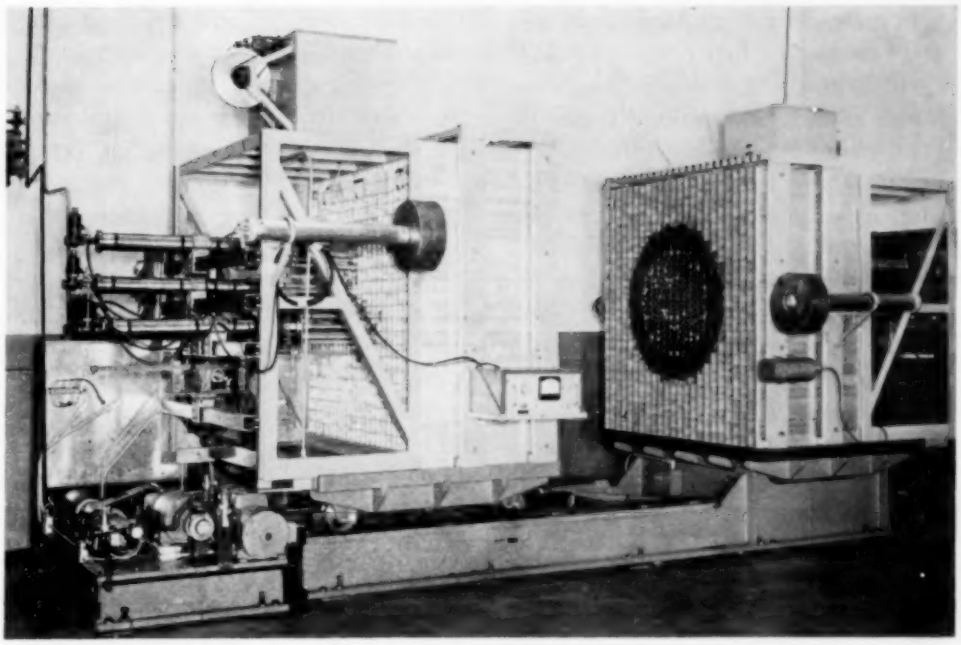
Liquid-moderated assemblies use a reactor tank in which the core and reflector components are assembled. The tank is mounted on the second level of a multilevel stand as shown in Figure 2. The control rod drives are mounted on the upper level while the tanks for storing the moderator (also coolant and reflector, if liquid) are located on the ground level.

Figure 3 shows an interior view of a typical water-moderated assembly. One fuel element has been removed from the can to show the aluminum tubes which contain the uranium dioxide used as fuel. The Y-shaped control blades have been disconnected and are inserted completely in the core. In beginning operation with an assembly such as this, about one-half of the fueled elements calculated to form a critical mass are loaded into the dry-core tank with all control rods inserted. Water is pumped by remote control from the storage tanks into the core. The neutron multiplication in the core is monitored by several detecting circuits. After full water height is reached, the control rods are withdrawn slowly, one at a time, and the multiplication recorded.

The rods are reinserted and the water dumped into the tank through a remotely operated valve. This procedure is iterated until criticality is attained with stepwise fuel additions. The magnitude of each fuel addition is based on the results of the previous runs. Initial criticality frequently requires 10 to 11 steps. After initial criticality, experimentation can proceed with future approaches to the critical condition made with fewer steps as more knowledge of the behavior of the system is obtained. In case of a malfunction the rods are dropped as the current operating the electromagnet is interrupted automatically. Simultaneously a spring

opens the dump valve in the bottom of the core tank and the liquid moderator is dumped into the storage tanks.

Solid-moderated reactors or solid systems with no moderator can be mocked up on a split-table arrangement like the one shown in Figure 4. The table on the right is stationary while the one on the left can be driven remotely from the control room to assemble the core. Part of the core is loaded onto each table with the control rods inserted. The tables are closed to within 6 in. of each other at a rate of about 40 in./min. The next 5 in. are travsersed at a slower speed, approximately 5 in. per minute. The last inch takes about two minutes.



4. *Horizontal stands for studies of solid-moderated reactors. Half the reactor core is assembled on each table. When contact between the two parts is made by moving the table on the left, the core becomes a unit and can operate. Control rods, which are inserted in both halves of the core, are at the back of the reactor half to the left.*

After the core has been assembled, the control rods are withdrawn one at a time and the multiplication of the core determined. The procedure can be reiterated in the same way as for the liquid-moderated assemblies. Control rods can be dropped and the tables separated by springs or a dropping weight to provide safety.

Sometimes the split-table assembly is used to mock up liquid-moderated reactors. For example, a boiling water reactor can be mocked up with polyethylene where the decreased hydrogen density in the water resulting from high temperature and steam bubbles is simulated by saw cuts or holes drilled in the plastic. Figure 5 is a photograph of a fuel element used to mock up a flat-plate element consisting of uranium-aluminum plates with boiling water in the channels between the fuel plates. The dimensions of the uranium foil and the thin plates of aluminum were chosen to duplicate the uranium and aluminum content of the actual fuel plate. The polyethylene strip has the same dimensions as the coolant channel. The hydrogen density of the polyethylene is varied by making traverse saw cuts, the frequency of the cuts being varied to simulate the boiling distribution in the reactor.

Solutions of uranium compounds such as uranyl nitrate or sulfate in water have been studied in critical assemblies. Their operation is somewhat like the liquid-moderated systems, but considerable care must be taken to maintain uniform concentrations and to prevent precipitation. The concentrated solutions are stored in small diameter tanks to insure a noncritical arrangement.

Instrumentation and Safety Systems

In controlling a critical assembly use is made of neutron flux or power level and the reactor period. In general, absolute flux or power level does not have to be known accurately. Most of the time the assembly is operated at 0.01 watt or so and the power trips are set at about 0.1 watt. Occasionally higher power runs are made to activate foils where power distributions are being measured. These runs are made at about 10 watts and trips set to "scram" at 15 watts.

The period is the time taken for the flux or power to increase by a factor of e = 2.718. Thus, a five-second period means the power level will increase by 2.718 in 5 seconds. If a critical assembly of any reactor gets on a very fast period, the rate of power increase may be so rapid that although the power trips work, the power may overshoot considerably while the rods are being actuated, causing damage to the core. In practice, fast periods are difficult to achieve, even intentionally, but to further insure safe operation reactors use period trips or scrams. These trips are generally set to operate if the period becomes as short as 3 to 5 seconds.

In many operations, three neutron-sensitive detectors and one gamma detector are used. Three neutron-sensitive ion chambers in which neutrons interact with a boron coating to produce alpha particles which, in turn, cause intense ionization in the gas inside the chamber, can be used to provide neutron level information. A scintillation crystal can be used to detect the gamma ray level.

The direct current signal from either detector can be differentiated to give a signal proportional to the reactor period. At Battelle, the signal from one neutron detector and the gamma-sensitive circuit are used to provide a period signal as well as power level signals. Thus, there are four power level signals and two period signals available to the critical assembly operator.

Any of the signals can interrupt the electric current to the electromagnets which support the control rods. Consequently, a malfunction detected by any one of the channels can automatically release all of the control rods which drop into the core shutting down the fission process.

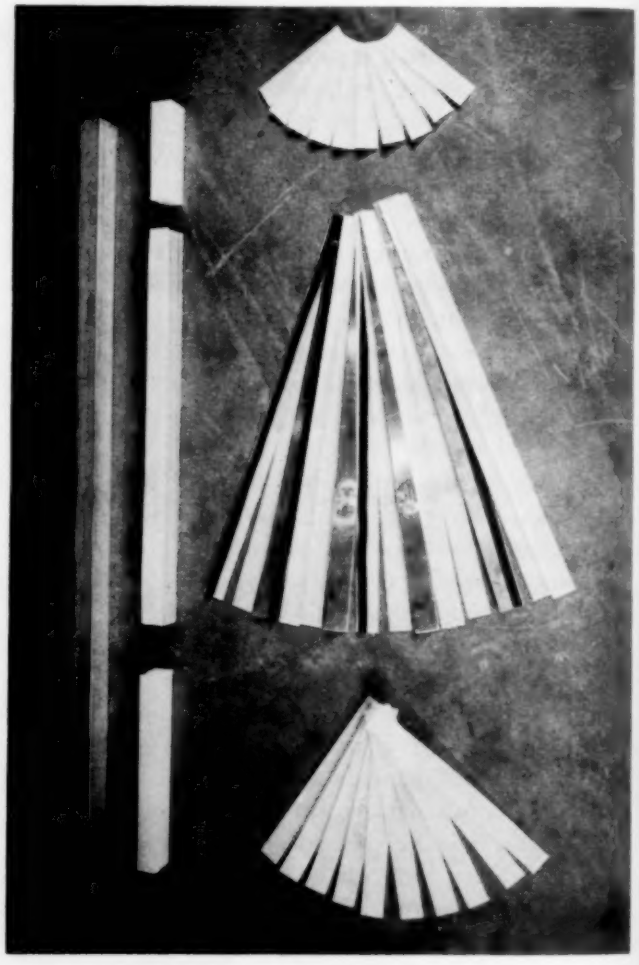
In addition to the safety or control circuits, several research channels are generally provided. Pulse-type detectors like the BF_3 counter are commonly used here because of their greater accuracy. By connecting these pulse-type detectors to a scaler, long reactor periods can be precisely measured. An accurate value of long reactor periods is essential to much of the experimentation, i.e., calibrating critical assembly control rods.

Typical Program

Critical assembly experiments are most effectively used when they are run in conjunction with computing machine calculations. The combination of experiments and calculations may actually prove to be less expensive than machine calculations alone. Certainly more confidence can be placed in the results from a program which utilizes experiments.

In a typical program the reactor physicist calculates, with the best available techniques after due consideration to time and cost, flux and power distributions, size, composition, and configuration of the core. With these preliminary design data the experimenter can begin designing the nuclear mock-up. In the initial experiments, a highly flexible critical assembly is used so that a range of parameters can be investigated rather easily. In this early stage exact duplication is not essential. The calculational techniques for obtaining the preliminary design are used to investigate the rather idealized geometry of the experiment over a similar range of parameters. Parameters most difficult to calculate theoretically are modified to bring agreement between the theoretical and the experimental results.

For a completely new reactor concept the modified calculational techniques may be used to provide a second design study on which to base further experiments. The critical assembly is then changed to duplicate the new design more exactly. The flexibility of the assembly is generally decreased in this step because of economic considerations. The second set of experiments is conducted to obtain detailed information on the important parameters outlined in the previous section. Experimental data are obtained in considerably more detail and with greater accuracy than in the early stages of the experiment. With this information, usually combined with more sophisticated calculations, the reactor design can be frozen and the core components fabricated.



5. *Examples of materials used in mocking up fuel elements for use in the critical reactor. Fans at top and bottom are polyethylene strips for simulating water reflector at top and bottom of the element. In the center fan are strips to simulate the fuel element itself—aluminum strips for aluminum cladding; uranium strips (dark) for the fuel; and white corrugated polyethylene strips to simulate boiling water. As assembled at the left of the fans, the mocked-up fuel element takes the place, in the critical reactor, of the real fuel element shown at the extrem left.*

Using the prototype fuel elements, control rods, and other core components, a zero-power experiment can be conducted. The prototype components may be assembled in the tank or on the table previously used for the critical experiments or in the actual power reactor vessel. Actually, conducting these experiments in the critical facility has the advantage of permitting construction to continue on the power reactor without interference and allows the power reactor to attain full power with less delay after construction is completed. Regardless of where they are conducted, zero-power experiments provide refined information on the operation of the actual fuel elements and control rods. Furthermore, the instruments to be used in the prototype reactor can be checked out and some idea of the response to be expected in initial reactor start up can be obtained.

An average time and cost for a critical assembly program is difficult to assess because many factors such as the newness of the reactor concept and the ultimate use of the prototype affect these items. Most owners of critical assembly laboratories quote operating costs per assembly of $500 per working day, a figure which includes amortization, use rate on equipment, manpower, and overhead. After the experiment has been constructed and put into operation, considerable data can be obtained in 6 to 8 months at a cost of $10,000-$14,000 per month. These operating costs would support a 6-7 man effort consisting of 3 professionals and 3 to 4 technicians and maintenance people. However, total costs depend significantly on the materials and size of the core and complexity of construction.

The Future

Many reactor experts believe the critical assembly may become a more, rather than a less, important device in reactor design. The nuclear analog aspect of the critical assembly makes it possible ot obtain specific design information more accurately and actually more quickly than by multigroup calculations. Frequently, the experimental data can be obtained at a lower cost.

As the library of design information increases, certain reactor types can be built without prior experimentation. Semi-empirical techniques based on the wealth of experimental data will be capable of determining the design with sufficient accuracy. However, new reactor concepts will undoubtedly continue to use critical assemblies.

Uses other than those for obtaining specific design information will become more important. Basic reactor physics data to aid in establishing improved computer methods may become much more important. With the growth of the nuclear industry, much more specific information of storing, handling, and shipping fuels, under conditions too complex to calculate, will be required. Some precedents have already been set for measuring the reactivity worth of each fuel element or control rod of succeeding core loadings for power reactors. These measurements provide an accurate method of quality control.

Critical assemblies can provide reactor information more quickly and accurately and in less time than any other method. Consequently, they will continue to be used for many years in conjunction with machine calculations to arrive at an optimum design.

TECHNOLOGY A MEANS, NOT AN END

"I suspect that some of our problems lie in our use of science as a crutch, as a mechanical device to relieve the world of the necessity for human judgment. Too many of us, I am afraid, rely upon our calculators and our mathematical formulae to chart our course in advance, to prove our case before trial, and to insulate us, in fact, against all risk.

". . . It is the responsible individual's role to evaluate the scientific tools at hand to the end that our technology is seen not as an end, but as a means; not as a substitute for human creation, but as its handmaiden; not as a replacement of reason, but as a result of reason.

"If we can derive from our studies a clear picture of personal responsibility and of personal initiative, then we can be sure that we will use our science wisely and not permit it to become obscured behind a cloud of irrelevant and superficial considerations. For no matter how the forms may change, the human qualities of the faith and courage and self-reliance are permanent and all-enduring essentials to progress."

Henry B. du Pont, vice president, E. I. de Pont de Nemours & Company

Better Castings through Computer Analysis

Production sensitivity and costliness of the newer metals, and exacting specifications associated with their use, make mathematical prediction of the casting behavior of such metals increasingly useful.

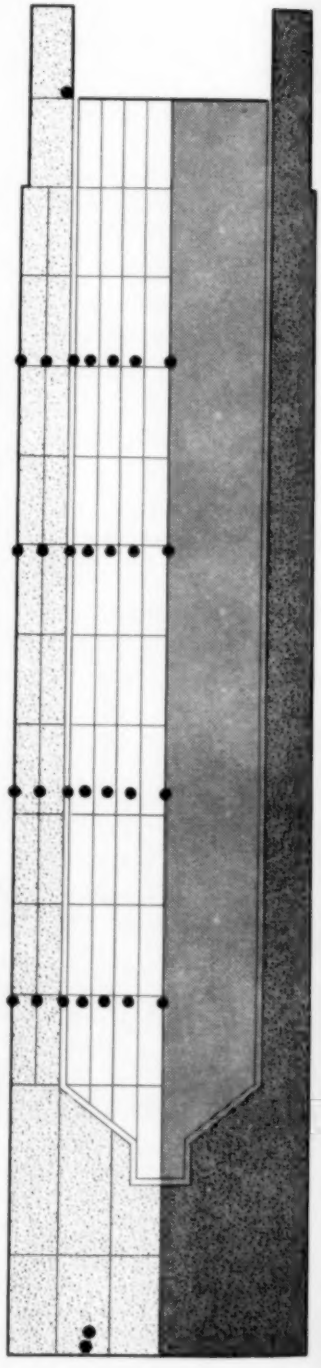
by ELLIS L. FOSTER *and* B. L. FLETCHER

ASIDE FROM ITS CHEMICAL composition, the qualities of a metal casting hinge principally upon the manner in which it freezes from the molten state. Such undesirable characteristics in the casting as alloy segregation and uneven concentration of impurities or porosity generally can be traced to some fault in the solidification pattern. These inhomogeneities, whether hidden in the microstructure or plainly visible when the ingot is stripped from the mold, profoundly influence the mechanical and physical properties of the material, its corrosion resistance, and its ability to be fabricated. Modern high-performance metals like niobium, molybdenum, and chromium alloys are particularly sensitive in this respect. It is not surprising, therefore, that the metallurgist, faced as he is with the task of making today's highly process-sensitive metals to ever more exacting specifications, must take great pains to insure that his casting techniques produce the the best possible solidification pattern.

Were it possible to change casting conditions at will, obtaining the optimum solidification mechanism would entail merely making simple modifications in procedure. However, economic considerations involving material yields, technical considerations relating to the temperature capability of available furnaces and mold materials, and the chemical reactivity of the metals being cast often make such adjustments impractical or impossible. Usually an expensive experimental program must be conducted to find, within the limitations posed by these economic and technical considerations, the best casting procedure for the product involved. Only slight subsequent alterations in the geometry of the cast shape may require repetition of the experimental work.

PROBLEMS IN PREDICTIONS

If the patterns of heat removal from a solidifying casting could be predicted accurately, it would then be possible to evaluate in advance a proposed way to cast a given metal. By relating the heat flow in the ingot to the movement of the solidification front—and this front is well defined in the case of high-purity metals—regions in which liquid metal would be entrapped could be located. Hot tearing and porosity from shrinkage and gas confinement are likely to occur in these regions. Further, the size and shape of risers and the benefits obtainable from hot topping could be defined by their influence on heat-flow patterns. In fact, virtually every variable entering into the casting process



1. *How the casting and mold were divided into cells to enable the construction of a mathematical model of heat flow. The dots indicate where thermocouples were placed for checking the validity of the calculations. A schematic representation of a section of the mold and casting and the basic mathematical expressions for determining heat flow through it are shown on page 11.*

could be evaluated on the basis of its effect on the solidification mechanism and the resultant soundness of the ingot.

The great benefits to the metal industry that would be derived from the finding of theoretical methods to predict heat flow during casting solidification have been recognized for a long time, and there have been many attempts to develop suitable techniques through the years. Early formal analytical methods required unrealistic assumptions to obtain a solution; for example, it was necessary to ignore such events as the release of heat of fusion, or to consider thermal properties constant over the range of temperatures encountered. Such methods were sometimes restricted to consideration of the heat flow in one dimension only, whereas analysis in two dimensions is required to detect conditions leading to shrink cavities.

The limitations of formal analysis led to the use of passive electrical network analyzers. This type of computer utilizes the analogy between thermal and electrical circuits, e.g., heat capacity is replaced by electrical capacity and thermal resistance by electrical resistance. The complexity of the thermal situation that can be studied by network analysis, however, is ultimately limited by the available and reliability of the capacitors, resistors, and other components. The modern, high-speed digital computer offers a promising tool for the solution of solidification problems.

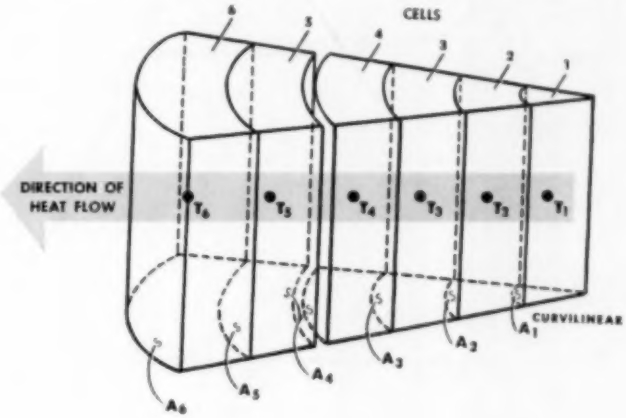
Prediction by Digital Computer

To conduct a study of casting problems on a digital computer, it is first necessary to construct a mathematical model that can be solved on the computer and that is adequate for describing the physical situation in a realistic manner. The model must be able to predict the thermal history of a casting made under specified conditions, these being the initial and boundary values of the mathematical statement of the problem. The computed predictions must be checked by experimental work. Once a satisfactory correlation has been established, the model can be used to predict the effects of altered casting procedures or geometries without the necessity for further direct experimentation in the melt shop. Possible economies are obvious.

A method of calculation that is suitable for solution on the digital computer is obtained by approximating the heat-flow equation by a finite-difference expression. The temperature field at a finite number of points in the casting and mold is calculated at the end of each of a series of short-time intervals that cover the period of interest. Since transient temperatures are calculated, the heat capacity must be introduced, and this is done

HEAT FLOW THROUGH A PIE-SHAPED SLAB

Terms describing the temperature variation of thermal properties and the vertical heat flow have been omitted.



Equations for cells, from right to left, as shown above:

1. $$\Delta T_1 = \frac{\Delta\Theta}{C_1}\left[K_{1,2}(T_2-T_1)\right]$$

2. $$\Delta T_2 = \frac{\Delta\Theta}{C_2}\left[K_{2,3}(T_3-T_2) + K_{1,2}(T_1-T_2)\right]$$

3. $$\Delta T_3 = \frac{\Delta\Theta}{C_3}\left[K_{3,4}(T_4-T_3) + K_{2,3}(T_2-T_3)\right]$$

4. $$\Delta T_4 = \frac{\Delta\Theta}{C_4}\left[A_4\sigma\, F_{a,4}\, F_{e,4}(T'^4_{5,k}-T'^4_{4,k}) + K_{3,4}(T_3-T_4)\right]$$

5. $$\Delta T_5 = \frac{\Delta\Theta}{C_5}\left[K_{5,6}(T_6-T_5) + A_4\sigma\, F_{a,4}\, F_{e,4}(T'^4_{4,k}-T'^4_{5,k})\right]$$

6. $$\Delta T_6 = \frac{\Delta\Theta}{C_6}\left[A_6\sigma\, F_{a,6}\, F_{e,6}(T'^4_{e,k}-T'^4_{6,k}) + K_{5,6}(T_5-T_6)\right]$$

The following definitions of terms apply:

T_n = temperature of Cell n, C

$T_{n,k}$ = temperature of Cell n, K

$T'_{e,k}$ = environmental temperature, K

ΔT_n = change of temperature of Cell in the finite time interval $\Delta\Theta$, C

$\Delta\Theta$ = finite time interval, sec

C_n = heat capacity of Cell n, cal per C

$K_{n,n+1}$ = thermal conductance between cell n and n + 1 ($= kA_n/x_n$), cal/(sec)(C)

k = thermal conductivity of materials in which cells are located, cal/(sec)(cm)(C)

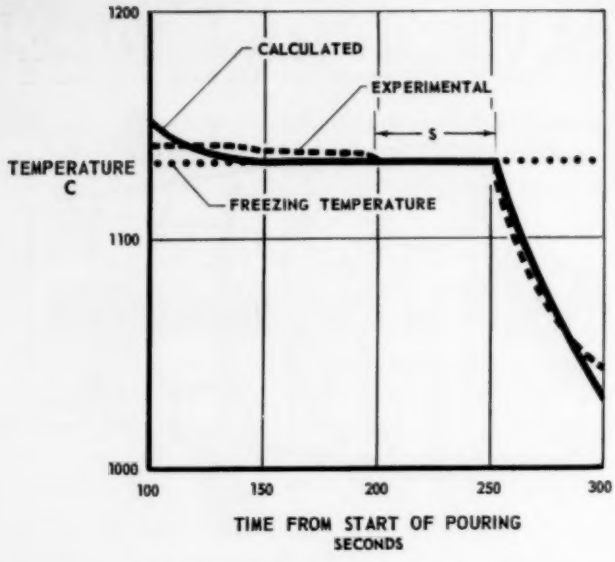
x_n = distance between centers of cells, cm

A_n = area of interface between cells, cm^2

$F_{a,n}$ = angle factor (dimensionless)

$F_{e,n}$ = emissivity factor (dimensionless)

σ = Stefan-Boltzmann constant [1.377×10^{-12} cal/(sec)(cm^2)(K^4)]



2. *Comparison of calculated and experimentally observed temperature during solidification near the vertical and radial center of an ingot.*

by describing the casting and mold as a number of discrete, connected cells as presented in simplified form on the previous page. The adequacy of the solution obtained is dependent upon selecting a proper number of cells and a suitable time interval. Using too short an interval can require excessive computational times, while too long an interval can cause an unrealistic, divergent oscillation of calculated results. These considerations are related to the problems of stability and convergence that are of importance in the numerical solution of differential equations.

An Experiment with the Mathematical Model

It should be recognized that the geometry and casting procedures used in the production of uranium ingots are the products of a technology that grew up almost over night. Increases in capacity were often made by the simple process of duplicating existing equipment. The product of this equipment also had to conform to the capabilities of the associated fabrication facilities. As a result of these necessary expediencies, a need arose to optimize the casting procedure within the limitation imposed by the equipment available. This need was recognized by the members of the AEC's Metal Quality Committee, and a study was initiated at Battelle under the direction and agency of the National Lead Company of Ohio, operator of the Feed Material Production Center.

The program at Battelle on the solidification of uranium castings furnishes an illustration of an actual application of the computer technique. The disadvantages inherent in the traditional trial-and-error experimental program are particularly evident in the melting and casting of uranium. Vacuum melting must be employed to eliminate atmospheric contamination and to remove hydrogen to the desired level. The graphite molds and crucibles, used because of their low cost, mechanical strength, and relative chemical inertness, make low pouring temperatures necessary to prevent carbon pickup and, because of graphite's high thermal conductivity, contribute to surface imperfections in the casting. Uranium's high intrinsic worth makes control of material losses unusually important.

The geometry of the particular casting considered was a right cylinder having a length-to-diameter ratio of 6-to-1, a simple shape, but not ideal in terms of ingot geometry when soundness is desired.

Variables and Phenomena Involved

Some of the variables and phenomena considered in the study were as follows: the heat flow from the ends of the casting, the time required to pour the cast-

Since his association with the Battelle staff, Ellis Foster's primary research interests have been the development of materials for use in reactor fuel elements and the study of problems in their preparation. He has conducted research on the melting and casting of refractory and reactive materials including zirconium, beryllium, niobium, tantalum, uranium, and thorium. He has investigated, also, nitrides of various metals, carbides of uranium and thorium, and beryllides for possible use in nuclear reactors. Foster has participated, also, in studies of the effects of impurities and additives on the properties of such materials.

B. L. Fletcher has participated in diverse studies in the Institute's digital computer laboratory. In addition to the computer analysis of casting solidification which he conducted in association with his co-author, Fletcher has contributed to the application of the digital computer to the investigation of nonlinear mechanical systems, the solution of thermodynamic problems, design studies, and to operations research. He graduated from the University of California, Los Angeles, with a B.A. degree in physics and is currently studying thermonuclear plasmas at Ohio State University.

ing, the separation of the casting from the mold (when the mode of heat transfer alters from conductive to radiative), the temperature dependence of the thermal properties of the liquid and solid metal and the mold material, the thermal effects of the mold coating, the release of heat of fusion, and the emissivities of the various heat-radiating surfaces.

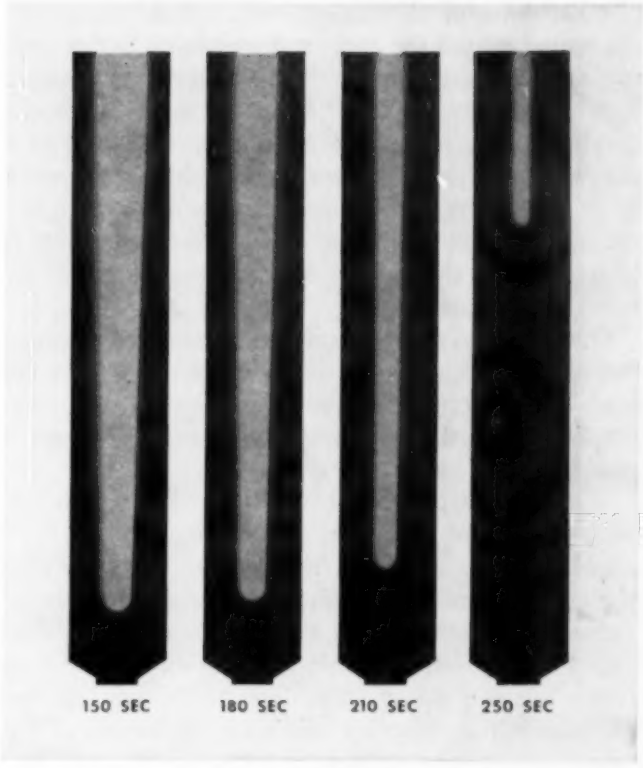
By varying input parameters, it was possible to study the effects on the solidification pattern produced by alterations in such factors as initial superheat, mold preheating, hot-topping, pouring time, outer mold coatings (affecting the emissivity), mold-wall thicknesses, the length-to-diameter ratio of the casting, and the temperature of the environment (the furnace jacket). The study of the other parameters of interest could be accomplished by making provision for these in the mathematical model, e.g., tapered molds and the use of insulating jackets at certain locations along the mold could be included in a more elaborate model.

In this particular problem, a medium-size computer installed at Battelle was utilized to solve the equations describing the heat flow from the casting and mold. Typical solutions required from 45 minutes to an hour of computer time, depending upon the actual solidification time of the casting. The computer output consisted of punched cards containing data as to the temperature of each cell at the end of each time increment, this giving a complete time-temperature history of the casting and mold. In addition, the heat of fusion that had been released from each of the solidifying casting cells at the end of each time increment was included in the output; these data made it possible to obtain a detailed picture of the progress of the solidification front.

Steps in the Study

As in all analyses, the validity of theoretical studies must eventually be established by comparison with experiment. In the case of the study of uranium castings, a concurrent experimental program made it possible to compare calculated temperatures with those measured by a thermocouple installation. Also, destructive examinations of the castings were made to check the calculated predictions as to the occurrence and position of voids.

Figure 2 presents a typical thermal history (both experimental and calculated) obtained along the center line—note that at 300 sec, 45 sec after solidification was completed, the results agree within 10 C (a 1 per cent error). Similar data were obtained at many other points within the casting and mold. Figure 3 shows a vertical cross section of the casting with the computed position of the solidification front indicated for various



3. *Vertical cross sections of a cylindrical uranium casting showing the calculated growth of solid metal at various times after the start of pouring (as noted under each sketch). The presence of the long narrow zone of liquid metal at 210 sec suggests that random void formation along the center line is likely.*

times. The appearance of this front at 210 sec is noteworthy in that a long, narrow zone of liquid metal is present, and this suggests that random void formation due to bridging along the center line is likely. Destructive examination of the actual castings (see Figure 4) revealed that this had occurred. The voids started at a point above the bottom where the computer solution indicated that the heat flow had altered from vertical to transverse, i.e., "controlled directional solidification" was no longer present. The other casting in Figure 4 was cast at a slightly higher superheat. The computer solution for this case indicated a tendency to displace the voids upwards along the center line, and this was found in the experimental casting.

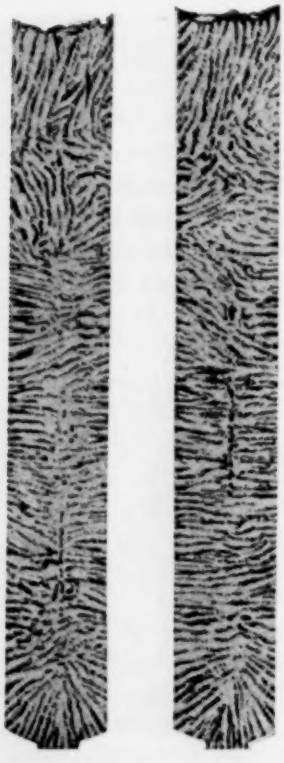
Future Applications

The demonstrated feasibility of using the general-purpose digital computer for solving one of the complex problems of concern to the casting specialist suggests other applications. The desirability of using computer analysis is obvious in the case of uranium because of its intrinsic value. Its application to other materials and shapes would also be attractive if the spe-

cific casting process were a costly one. For instance, the application of the analytical technique to the evaluation of the variables involved in continuous casting appears practical. Since it is a large-scale operation, varying conditions in practice is inconcenient. A suitable computer model for example would permit evaluation of the dynamic cooling that occurs where the casting and mold are in contact and where a coolant is sprayed upon the casting as it withdraws from the mold orifice.

Other studies could be used in developing specifications as to the optimum shape and size of risers for foundry casting needs. Such variables as mold materials, pouring temperatures, and metal properties could be considered and evaluated.

While the experience to date has been with unalloyed materials, the extension of the analytical technique to alloys is considered feasible. Assuming that the same type of results would be available for alloyed as for unalloyed materials, the location of the liquidus and solidus isotherms and the quantity of heat of fusion released would again describe the solidification patterns in the ingot. By inference, the effects of different casting conditions on structure, segregation, and porosity could be studied.



4. Cross sections of actual castings show random voids formed where the computed solution had indicated. The casting at the left was poured at 1338 C, the one on the right at 1380 C.

Two other metallurgical processes that could be examined by this analytical technique are heat treatment and fabrication. The application to heat treatment would be straightforward since heat-transfer processes are directly involved: the method should be useful in evaluating what times in various media or furnaces at different temperatures would be necessary to achieve the desired effect. Evaluations could be made of such things as times to attain temperature and time at annealing or solution temperature and the resulting grain growth, determinations of the depth of hardening occurring in a shape in different quenching media, or the extent of tempering effected in an as-quenched structure.

Fabrication processes also have characteristics that can be studied by these techniques. For example, the temperature attained by a forging is the product of the metal properties, the energy imparted in forming, the metal's initial temperature, and the heat losses by conduction, convection, and radiation. The mechanical properties also vary with temperature, and the ability of a material to be formed may lie within a certain temperature range.

Two limitations to digital-computer solution of casting problems are (1) the scarcity of information on the thermal properties of materials at high temperature and in the liquid phase, and (2) the difficulties encountered in describing the effective heat transfer at the metal-mold interface during the pouring and initial solidification of the casting. Obtaining this type of information by experimental means is laborious and difficult. Experience that has been gained in the solidification studies indicates that the computer method of solution provides an indirect means for establishing the thermal significance of the phenomena of interest. It is considered feasible that this approach could be used in defining the quantitative value and/or importance of: (1) heat of fusion and thermal resistance of the metal-mold interface, and (2) the extent of mold-metal gapping, the sequence of its occurrence, and whether the ingot reestablished contact with the mold.

A number of low-melting-point metals for which thermal properties have been accurately established, i.e., mercury, aluminum, lead, and tin, could be used for such studies, utilizing experimental setups, and mathematical models of the systems. Then the results of both the experimental and mathematical efforts would be compared and the thermal events occurring at the mold-metal interface subjected to close scrutiny. Here the mathematical model wiuld be revised to better fit the physical and sequential events indicated at the interface during solidification. In the example above, the results calculated at the wall cells during, or soon after, pouring would be most informative. If, however, a thermal property such as liquid conductivity or the heat of fusion were of interest, it would be most profitable to study the results that gave data on the total-solidification time at the center of the casting.

The digital computers presently available, along with the rapid developments in computer programming and numerical-analysis techniques, indicate an ever-growing scope of application to engineering and scientific problems. The metallurgist can benefit from these developments by reconsidering his problems in heat transfer in light of the capabilities of this modern engineering tool.

NOTES from BATTELLE

* PULSATIONS IN OIL FIRED UNITS

The causes of pulsations in oil-fired heating units have been sought in a recent study at Battelle supported by The American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., The Oil-Heat Institute of America, Inc., and The American Gas Association. In summarizing the findings of the study, Abbott A. Putnam and Carl F. Speich presented the difficulties inherent in finding methods of suppressing pulsations.

They point out that the pulsations result from acoustical phenomena though the energy for driving the pulsations comes from the combustion process. The acoustical system determines the frequency, and to a large extent, the amplitude of the pulsations. Furnace and burner variables which affect the combustion process affect the acousutical system also, though how the latter is affected is less clear than in the combustion process. Because so little is known about the effect of furnace and burner variables on the acoustical system, the aim of the study has been to explain the mechanism of pulsation in terms of those variables. The important variables have been found—furnace volume, fuel-spray pattern, air pattern, and the pattern of the recirculated hot-combustion products. The complex nature of the physical handling of the fuel, air, and combustion products, however, has prevented a full determination of the effect of these variables on the acoustical system.

The mechanism of pulsation was found to involve two independent phenomena: an acoustic pressure oscillation and a periodic rate of heat release. The former has been shown to result from the acoustical behavior of the furnace. The periodic heat release is controlled by the periodic ignition of the combustible mixture in the furnace, which, in turn, appears to depend on the local air-fuel ratio of the combustible mixture in the ignition regions downstream of the blast-tube exit. Why these particular regions have dominance over ignition in any other region within the combustion chamber, or how burner configuration affects the location of these regions, is not fully known.

Putnam and Speich state that any suppression technique should affect either the acoustic-pressure oscillation or the periodic rate of heat release. Thus, venting the combustion chamber would be expected to affect the pressure oscillation by relieving the acoustic pressure within the furnace. And, while it should be possible to suppress pulsations by affecting the periodic rate of heat release, not enough is known about the location of the ignition regions or about what conditions are needed in these regions to prevent pulsations to accomplish such suppression. Hence, it is not now possible to devise definitive techniques involving the fuel-spray pattern, air pattern, or recirculation pattern that will suppress pulsations in all circumstances.

* HUMAN ELEMENT IN AUTOMATION

A "problem making" analog computer and a control panel are helping scientists to understand better the effects of automation on persons who supply the necessary human element in complex man-machine systems. This equipment has been used for more than a year at Battelle in a study sponsored by Wright Air Development Division's Aerospace Medical Laboratories—a component of the Air Force's Air Research and Development Command.

The computer-fed control board, with its array of lights and buttons, is designed to simulate the kind of equipment in a man-machine system that requires constant human attention, according to Ralph Thomas and Alan Pritsker, Battelle technologists who head up the study. For instance, the control board can simulate the conditions facing the operator of a radar alert system or of the complex controls used in a chemical processing plant.

The control panel, in effect, demands that the operator remain constantly alert to answer three questions through the use of a series of buttons: 1. Is the system operating as it should be? 2. If it isn't, what correction should be made? 3. Was action taken effective in correcting the system? These questions are basic to automation problems, and they will have to be answered in the control of systems no matter how sophisticated machines become. Indeed, with more complex automation systems, it will become increasingly important to designers to know how well, how quickly, and how often a man can be relied upon to answer these questions.

A man may be "overworked" with too many decisions and unable to do his part in a machine system, thus making the whole system ineffective; or the ma-

chine may require human decisions so infrequently that the operator becomes inattentive and fails to respond promptly when human action is required, Dr. Charlotte Christner, psychologist on the Battelle research team, observes.

According to Walter J. Huebner, who is coordinating the program for the Wright Air Development Division, "Research may, in time, make it possible to understand what the desirable balance is between the work load of the machine and the man. The exploratory work of Battelle scientists has thus far resulted in a clear definition of automation and a mathematical model and apparatus for studying man-machine relationships."

* SWELLING OF ELASTOMERS

Swelling and water absorption are twin problems that beset those who seek effective materials for gaskets and seals in steam and hot-water systems. In a recent study at Battelle, Stephen Palinchak and William J. Mueller sought the factors that determine the service life of such materials. According to the chemists, gum stocks, fillers, vulcanizates, and electrolyte impurities (in rubbers and fillers) appear to be the most important factors.

Of the materials they studied, Palinchak and Mueller found that silicone and butyl elastomers exhibit the least swelling and water absorption; the acrylate polymers have the highest water absorption, possibly because of amine curing agents used in their vulcanization. In general, increasing the polarity of the rubber or its electrolytic impurity tends to increase swelling and water absorption. The nitrile polymers examined, however, despite their polarity, display surprisingly little swelling.

Experimentation indicates that fillers (especially nonblack types) may either increase or decrease water absorption, depending on the polymer used. Carbon blacks, however, always decrease water adsorption. Interestingly, fillers that produce high swell in nonwater-absorbing polymers decrease the swell in high-swelling rubbers such as neoprene and SBR-1500.

A major cause of high water absorption appears to be the presence of an electrolyte impurity in either the polymer or the filler. Thus, SBR-1500 (containing 1.5 per cent soluble ash) swells about 25 per cent, while SBR-1503 (with 0.1 per cent soluble ash) swells only about 5 per cent.

Effects of long-term aging cannot be estimated from short-term tests, say the chemists, since results of short-term tests do not correlate with long-term aging tests.

* COLUMBIUM ALLOYS FOR REACTORS

Columbium (niobium), because of its excellent elevated temperature strength potential and relatively low neutron absorption cross section, has attracted attention as a cladding material for fuel elements in pressurized water and steam reactors. The metal does not significantly decrease in strength below 1500 F, whereas even the best zirconium alloys, now favored for such use, lose strength at about 700 F.

In a study of the corrosion resistance of columbium and columbium alloys for the Atomic Energy Commission, Battelle metallurgists William D. Klopp, Warren E. Berry, and Daniel J. Maykuth reached the following general conclusions:

- Unalloyed columbium corrodes at unacceptably high rates for reactor applications in water and steam at 600 to 750 F.

- The metal's corrosion behavior is improved significantly by alloying with vanadium, titanium, titanium-chromium, and zirconium. The best alloys are more corrosion resistant than zirconium alloys and do not exhibit the breakaway phenomenon observed in the latter at 680 and 750 F.

- Oxygen and hydrogen absorption does not appear to be a serious problem with columbium alloys.

- Corrosion behavior of the alloys is similar to their high-temperature oxidation behavior and can be correlated with certain properties of the alloy additions. The latter are valence and ionic size of the alloying element (both operative at low alloying levels) and the stability and diffusion resistance of new oxides formed by the alloy additions (operative at higher alloying levels).

- Based on cross-section and corrosion behavior, columbium-vanadium and columbium-zirconium alloys are most attractive for use in thermal reactors.

* Just published is the first volume of the second edition of the AEC *Reactor Handbook*.

Sections covering fuel materials, control materials, and moderator materials, were edited by H. A. Saller and Clyde R. Tipton, Jr., Stan J. Paprocki, and Eugene M. Simons, respectively—all of Battelle. Other sections and their editors: cladding and structural materials, J. R. Keeler; coolant materials, R. N. Lyon; shielding materials, V. P. Calkins.

The volume, titled *Materials*, is published by Interscience Publishers, Inc., and has been rewritten, reorganized, and enlarged, Tipton, its editor, reports. It carries an appendix of constitutional diagrams of binary alloy systems compiled by Arthur A. Bauer and S. Alfant.

* Current emphasis upon the newer metals has grown out of the need for materials with properties superior to those of existing materials for aircraft, nuclear energy, and communications applications. As an aid to metallugists concerned with materials problems in these fields, the American Society for Testing Materials has just issued a new volume, *Symposium on Newer Metals*, R. E. Hess, editor.

The work contains three major sections: Properties of Refractory Metals; Nuclear and Light Metals; and Processing of Newer Metals.

Contributions by Battelle staff members include an introduction by Robert I. Jaffee; "High-Temperature Properties of Tantalum" by Frank C. Holden, F. R. Schwartzberg, and Robert I. Jaffee; and "Tensile Properties of the Platinum-Group Metals" by Frank C. Holden, Richard W. Douglass, and Robert I. Jaffee.

Copies are available from the Society, 1916 Race Street, Philadelphia 3, Pennsylvania.

* Battelle staff members recently named to technical posts include: *Benson G. Brand*—chairman, Subcommittee IX on Varnishes, American Society for Testing Materials; *Jack J. Bulloff*—chairman, Symposium Committee, Ohio Academy of Sciences; *Horace J. Grover*—chairman, Committee F-9 on Fatigue, ASTM; *Iver Igelsrud*—member, Advisory Committee, Office of Documentation, National Academy of Sciences - National Research Council; *Robert I. Jaffee*—U. S. representative, Advisory Group for Aeronautical Research and Development of NATO, Materials Group Meeting in Athens and Istanbul (September 27 to October 4, 1960) *and* chairman, Subcommittee VIII on Miscellaneous Metals, ASTM *and* member, Refractory Metals Committee, Institute of Metals, American Mining, Metallurgical and Petroleum Engineers; *H. W. Lownie*—vice chairman, Committee A-3 on Cast Iron, ASTM *and* member, Council, Division of Materials Science Sumposium and Organization; *John D. Sullivan*—member, Advisory Committee, Materials Sciences Division *and* member, Advisory Committee, Committee C-8 on Refractories, ASTM; *William J. Zielenbach*—vice chairman, and *William A. Glaeser* and *Frederic K. Orcutt*, members, Technical Committee on Bearings and Bearing Lubrication, American Society of Lubrication Engineers.

Writings by STAFF Members

Cobalt, no. 7, June, 1960, contains the following writings by staff members:

The Welding and Brazing of Certain Cobalt-Containing Alloys. W. J. Lepkowski and R. E. Monroe, pp. 6-12.

As corrosion and heat-resistant materials, the cobalt-containing alloys resemble certain austenitic types of stainless steels. Processes and techniques applicable to the welding of the latter can also be used on the former after slight modification. Most brazing of parts for elevated-temperature service is done in purified, dry hydrogen. In general, the strength of joints of the alloys that are not readily brazed in hydrogen will be higher when vacuum brazed.

Non-Metallic Dispersions in Cobalt and Its Alloys. II. Sintered High-Temperature Chromium-Cobalt Alloys. Rudolph Palme, pp. 13-25.

The high room-temperature tensile strength of the sintered specimens is presumably due both to finely dispersed oxides and to non-equilibrium structures. A small increase in the sintering temperature and time from the level where highest room-temperature strength was achieved resulted in improved creep resistance.

Contribution to the Magnetic Properties of Some B8-Type Phases. Hans Schmid, pp. 26-32.

Show: that the Curie law does not hold for the compounds CoSb, NiSb, NiTe, etc., which are characterized by a small number of uncompensated 3d-electrons in the T-metal and a high valency electron concentration in the B-metal.

Which Metals for High Temperature Structures? V. D. Barth and H. R. Ogden. *Space-Aeronautics*, v. 13, no. 1, Jan. 1960, p. 129 + 6 pages.

As the requirements of high temperature aerospace structures increase, so does the variety of metals and alloys suggested to meet them. This article sorts out the many promising metallic high temperature materials that have appeared recently and shows where and how they can best be used.

Fluidized-Bed Coating of UO_2 Powder with Niobium and Other Elements. John M. Blocher, Jr., Neil D. Veigel, Joseph H. Oxley, Virginia M. Secrest, and Erland E. Rose. U. S. Atomic Energy Commission, BMI-1440, May 25, 1960, 45 pp. + appendix. (OTS $1.50)

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The chemical vapor disposition of niobium, molybdenum, tungsten, chromium, carbon, and niobium-vanadium alloys in a fluidized bed of UO_2 powder particles has been used to provide uniform, dense, nonporous coatings on the individual particles. In the case of niobium, which received major attention, H reduction of niobium pentachloride vapor was used as the vapor-deposition reaction. The most serious problem was that of maintaining bed fluidity and avoiding agglomeration. This problem was overcome to permit routine operation of the coating equipment.

How Radiation Affects Engineering Materials. Richard E. Bowman. *Materials in Design Engineering*, v. 52, July 1960, p. 119-134.

Gamma rays and neutrons cause property changes in the environment. Structural metals generally have best radiation resistance. Inorganic materials show many changes in physical and mechanical properties. Elastomers vary widely in radiation resistance. Plastics generally have equal or better radiation resistance than elastomers. Organic fluids can have composition adjusted to provide compromise of properties.

Relations Between Simple and Complicated Oxygen Acids. Jack J. Bulloff. *Ohio Journal of Science*, v. 60, no. 3, May 1960, p. 129-143.

Relations between simple and complicated oxygen acids can only be completely understood in terms of a general knowledge of oxyanions. This same general knowledge is needed in order to complete our knowledge of simple oxygen acids. The study of complicated acids and their derivations can be expedited by short cut techniques adapted to survey procedures in order to make maximal use of the minimal amount of definitive structural information that can be made available in a limited time. A tentative terminology has been suggested for complicated oxygen acids and their derivatives which has some advantages over present terminology.

Accelerated Testing as a Problem of Modeling. Hall Cary and Ralph E. Thomas. *Proceedings Sixth National Symposium on Reliability and Quality Control in Electronics*, IRE, Washington, D. C., Jan. 11-13, 1960, p. 69-87.

Mathematical criteria are developed that indicate the conditions under which reliability data obtained from "accelerated" tests can be used to predict reliability under "normal" use. In addition, a simple model-prototype relation is developed that is suitable for application to accelerated test programs when environment stresses are negligible. An experimental procedure is proposed that involves a set of "accelerated models" that are tested under high "abuse ratios" until one catastrophic failure occurs.

Some Optical Properties of Cadmium Telluride. P. W. Davis and T. S. Shilliday. *Physical Review*, v. 118, 2nd ser., no. 4, May 15, 1960, p. 1020-1022.

Some optical properties of CdTe samples having a carrier concentration of the order of 10^{15} cm^{-3} were measured. The index of refraction in the infrared was determined to be 2.61. Values of the absorption coefficient α as a function of frequency were obtained as various temperatures. By plotting $\alpha^{1/2}$ and and α^2 against frequency, it was found that at room temperature, the minimum energy for direct transitions is 1.50 eV; that for indirect transitions, it is 1.44 eV. The temperature dependencies between 77 K and 373 K are given by $(1.66\text{-}5.6\times10^{-4}T)$ eV for direct transitions and $(1.56\text{-}4.1\times10^{-4}T)$ eV for indirect transitions.

Life Characteristics of Surface Barrier Transistors. James E. Drennan. *Proceedings, Sixth National Symposium on Reliability and Quality Control in Electronics*, IRE, Washington, D.C., Jan. 11-13, 1960, p. 370-376.

A program was conducted to determine the life characteristics of surface barrier transistors used in a particular computer system. The primary objective of the evaluation was to subject these transistors to simulated-use life conditions without any extraneous degrading influences causing parameter changes over and above those caused by the environmental and loading conditions. The results of the life evaluation and the formulation of methods for predicting the failure of these transistors are discussed in detail.

Stabilization of Mixed Polyamides. M. M. Epstein and C. W. Hamilton. *Modern Plastics*, v. 37, no. 11, July 1960, p. 142 + 8 pages.

Presents the results of experimental work conducted on five different mixed polyamide compositions. The subject of heat stability is considered in detail, as this aspect is a formidable problem.

Antimonate Glass for Infrared-Transmitting Windows. W. A. Hedden and B. W. King. *American Ceramic Society, Journal*, v. 43, July 1960, p. 387-388.

A glass compostion containing 63% Sb_2O_3 and 15% Al_2O_3 was developed which had improved transmission characteristics at wave lengths between about 4 and 6 μ.

Some Extreme Principles of Mathematical Physics. *(In French)* Sur quelques principes extremaux de la physique mathematique. Joseph Hersch. *L'Enseignement Mathematique*, v. 5, no. 4, 1959, p. 249-257.

In connection with the Dirichlet problem and the problem of the fundamental frequency of a vibrating membrane. The author studied the electric conductivity of a homogeneous plate. An interpretation of the Dirichlet principle and of the Thomson principle is offered as well as a passage from Dirichlet to Thomson by means of the lines of flux of a vector field. An approach is found toward a Thomson principle for the vibrating membrane.

A Method for the Evaluation by Default of the First Intrinsic Value of the Vibration or Buckling of Built-Up Plates. *(In French.)* Une methode pour l'evaluation par defaut de la premiere valeur propre de la vibration on du flambage des plaques encastrees. Joseph Hersch. *Comptes Rendue Hebdomadaires des Seances de l'Academie des Sciences*, v. 250, June 13, 1960, p. 3943-3945.

One-dimensional auxiliary problems are elaborated on parallels having three or four stable directions. The method suggested is essentially that of Weinstein and Aronszajn and can be applied to any "G" domain, irrespective of the solution of the problem of the vibrating membrane for "G". A special form of the concurrent function leads to some explicit evaluations.

Mechanical- and Physical-Property Data on Modified 12 Per Cent Chromium Martensitic Stainless Sheet Steels for Airframe Applications. J. G. Hoag, D. B. Roach, and A. M. Hall. PB 161 165; *DMIC Memo* 15; April 18, 1959, 56 pp. (OTS $0.50)

Modifications of the basic 420-type analysis are usually obtained by addition of various combinations of NI, N, Mo, V, W, and Cu. Room-temperature and short-time elevated-temperature tensile properties, effect of elevated-temperature exposure on strength, and compressive, impact, creep, rupture, and fatigue properties are presented.

Nitriding of Titanium. J. W. Holladay. PB 161-179; *DMIC Memo 29;* August 12, 1959, 13 pp. (OTS $0.50)

Discusses thermodynamic and kinetic considerations, media and procedures, use of nitrogen and ammonia gases, effect of alloy composition, and nature and properties of the nitride coating.

A Brief Review of Refractory Metals. R. I. Jaffee. PB 161 190; *DMIC Memo 40;* December 3, 1959, 37 pp. (OTS 0.50)

The refractory metals are taken as the metals with melting points equal to or higher than that of chromium, 1875 C. Availability, extraction, consolidation, low-temperature brittleness, high-temperature properties; oxidation characteristics, protection against oxidation, and fabrication data are given.

Refractory Materials II. High-Temperature Behavior. Robert I. Jaffee and Daniel J. Maykuth. *Aero/Space Engineering*, v. 19, July 1960, p. 39-44.

Part I discussed the general technology of refractory materials, their stability. Part II discusses their mechanical behavior at elevated temperatures and the physical properties important in controlling thermal stresses developed in structural applications. Future trends for these materials are also suggested.

Induction-Pressure Welding of Girth Joints in Steel Pipe. R. L. Koppenhofer, W. J. Lewis, G. E. Faulkner, P. J. Rieppel, and H. C. Cook. *Welding Journal*, v. 39, July 1960, p. 685-691.

Welding studies were made with the induction-pressure welding process on standard c-¾ in. OD pipe. It was found that satisfactory welds, which had bend ductility and tensile strengths in excess of those specified by API for field-welded joints, could be made consistently with proper welding conditions, argon shielding and a square-butt closed-joint design with good joint aligment. It is readily adaptable to in-plant or yard joining operations and, with adequate engineering design, could be used on a pipe-line spread under actual field conditions. A practical limit for field-welding applications would probably be about 20 in. in diam.

High-Temperature Metals. C. A. Krier. *Journal of Metals*, v. 12, July 1960, p. 574-576.

Surveys extraction processes, fabrication, properties, and applications of CR, CB, Hf, Mo, Re, Sc, Ta, W, V, Y, and the Pt-group metals.

A Kinetic Study of the Thermal Decomposition of Tetraphenylsilane, Triphenylphosphine, Diphenyl Sulfide, Sulfoxide, and Diphenyl Sulfone. Arthur Levy and Charles J. Ambrose. U. S. Air Force, Wright Air Development Center, *WADC Technical Report*, 59-560, Oct. 1959, 34 pp. (OTS $1.25)

The gas phase decomposition kinetics of diphenyl sulfoxide, diphenyl sulfone, triphenylphosphine, diphenyl sulfide, and tetraphenylsilane were studied between 350 and 650 C. The decompositions are first order and the principal decomposition products common to all five compounds are benzene and high molecular weight polymers. Other major products obtained include sulfur dioxide and diphenyl sulfide from the sulfoixde; sulfur dioxide from the sulfone; hydrogen and phosphorus from the phosphine; hydrogen, hydrogen sulfide, and dibenzothiophene from the sulfide; and hydrogen and silicon from the silane. The kinetics suggest a molecular rearrangement mechanism, although a free-radical mechanism is not entirely excluded.

Experience with Strain Gages on Large-Diameter Buried Pipelines. George McClure. *Oil and Gas Journal*, v. 58, no. 14, Apr. 4, 1960, p. 92-96.

Discusses some of the problems encountered and the techniques used in the field application of bonded-wire strain gages on buried gas transmission pipelines. This work was carried out under the sponsorship of the American Gas Association with the aim of obtaining data on long-time stress changes in buried lines. General considerations of gage application of wiring, and specific techniques for long-time waterproofing of strain gages under adverse field conditions are presented.

Melt Flow of Linear Polyethylene. A. F. Metzger and C. W. Hamilton. *Rubber Age*, v. 87, no. 4, July 1960, p. 635-639.

Discusses the limitations of certain commonly accepted test methods and illustrates the differences that can be expected in the flow behavior of commercial high-density polyethylenes. Factors affecting melt viscosity, theoretical aspects of rheology, and need for high-shear measurements are reviewed.

Preparation and Properties of AlSb-GaSb Solid Solution Alloys. J. F. Miller, H. L. Goering, and R. C. Himes. *Electrochemical Society, Journal*, v - 107, June, 1960, p. 527-533.

Ingots of the quasi-binary GaSb-AlSb alloy were prepared by progressive casting and one casting at various rates of crystallization. Results of X-ray diffraction studies, metallographic studies, hardness determinations, and chemical analyses indicate that, with the possible exception of a narrow composition range between 10 and 30 mole % AlSb which was not investigated, solid solution prevails in the system. Vegard's law was found to be at least roughly applicable; with lattice constants for the alloys ranging between values of 6.0963 A for pure GaSb and 6.136 A for pure AlSb. Optical energy gaps determined for alloy specimens increased regularly with cell size from a value of 0.68 ev for GaSb to a value of 1.74 ev for AlSb.

Arc Welding of High-Strength Steels for Aircraft and Missile Structures. J. T. Niemann, R. P. Sopher, and P. J. Rieppel. PB 161 177; *DMIC Memo 27*, July 31, 1959, 45 pp. (OTS $0.50)

Presents data now available on arc welding hot-work die steels, martensitic and precipitation-hardening stainless steels, and low-alloy hardenable steels which have room-temperature yield strengths in excess of 200,000 psi.

Band Sawing of Titanium and Titanium Alloys. Carl T. Olofson. PB 161 173; *DMIC Memo 23;* July 1, 1959, 15 pp. (OTS $0.50).

Gives information on saw and workpiece characteristics, conditions of setup, cutting fluids, cutting speeds and feeds, and other operational data.

Further Development of Gas-Pressure Bonding of Zircaloy-Clad Flat-Plate Uranium Dioxide Fuel Elements. Stan J. Paprocki, et al. U. S. Atomic Energy Commission, BMI-1436, May 11, 1960, 58 pp. (OTS $1.50)

Techniques were developed for the application of barrier layers of chromium by a vapor-deposition process and of crystalline carbon by a pyrolytic process. These coatings, together with a graphite coating developed previously, were then evaluated in pressure-bonded fuel elements for their effectiveness in preventing core-to-cladding reaction and for their general production feasibility. Crystalline coatings 15 to 40 in. thick and chromium coatings 25 to 40 in. thick were determined to be satisfactory. In the study of the flow of cladding-plate material into void spaces in the picture-frame assembly, it was established that excessive flow, and consequent thinning of the cladding, can be minimized by individually compartmentalizing the cores with Zircaloy ribs.

Selecting and Training the High-School Graduate as a Draftsman. Ralph L. Paul. *Graphic Science*, v. 2, July 1960, p. 19 + 2 pages.

The small drafting department at Battelle Memorial Institute sets up a successful training program for four young men.

Welding Solid-Fuel Rocket Motor Cases. P. J. Rieppel. *Metal* Progress, v. 78, no. 1, July 1960, p. 105-110.

Hot cracking of weld metals and notch sensitivity of high-strength steels at maximum strength levels pose serious challenges to fabricators of rocket motor cases. Most failures stem from poor welding techniques and inadequate inspection. Some of the recommended practices to combat these problems are discussed. This paper is a summary of information from Defense Metals Information Center reports (DMIC Report No. 118, Oct. 12, 1959, and a recent DMIC Memorandum) by M. D. Randall, R. E. Monroe, H. W. Mishler, and P. J. Rieppel. The information was collected with the cooperation of many companies in the aircraft and missile industries.

An Evaluation of Data on Nuclear Carbides. Frank A. Rough and Walston Chubb. U. S. Atomic Energy Commission, BMI-1441, May 31, 1960, 100 pp. (OTS $2.25)

Available data on the physical and mechanical properties, constitution, compatibility, and radiation behavior and on fabrication methods for uranium, thorium, and plutonium carbides were located. Only limited data on the physical and mechanical properties of uranium carbides were discovered. No information on high-temperature mechanical properties was found. Considerable information concerning the constitution of the carbides was obtained, however, and ternary diagrams were constructed. The incomplete data on the compatibility and corrosion behavior of the carbides that were found in the litera-

ture were supplemented by thermodynamic calculations for various possible reactions with coolants and claddings. Available information on preparation of bulk carbides was reviewed and data on thermodynamics, preparation by chemical reactions, melting and casting, solid-phase fabrication, and storage and handling were assembled.

New Routes to Better Electroplate for Zinc Die Castings. W. H. Safranek. *Metal Prograss*, v. 78, no. 1, July 1960, p. 69-75.

In answer to demands for better corrosion protection for zinc die castings, electroplaters have come up with three promising plating practices—duplex nickel, crack-free chromium and duplex chromium. Duplex nickel is now in wide use and increased application of crack-free chromium for improved performance is predicted. It is suggested that duplex chromium (greater than 0.1 mil) might be more economical for those plants not adopting duplex nickel.

Explosion-Bulge Tests of Armor Weldments. S. M. Silverstein, R. P. Sopher, and P. J. Rieppel. *Welding Journal*, v. 39, July 1960, p. 309s-314s.

A study was made of ferritic Grades 260, 230, and 180 electrodes as well as austenitic Type 307 electrodes deposited in butt joints in a single heat of 1-in. Army Ordnance armor plate. Speciments were explosion tested over a range of temperatures to determine the ductile-to-brittle performance temperature range of the weldments. There was little difference in the performances of the weldments made with the high-strength ferritic and the austenitic electrodes; weldments prepared with the Grade 180 electrodes were definitely inferior to the other weldments.

Properties of 70-30 Copper-Nickel Alloy at Temperatures Ranging up to 1050 F. W. F. Simmons, B. J. Sirois, D. N. Williams, and R. I. Jaffee. Paper from *American Society for Testing Materials, Proceedings, 1959*, v. LiX, pp. 1035-1051, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

Some physical and mechanical properties for Cufenloy 30, a wrought 70.0 copper, 20.1 nickel, 0.5 iron, and 0.35% manganese alloy, in the drawn and stress-relieved temper are given at elevated temperatures. The physical properties include thermal expansion, thermal conductivity, electrical resistivity and conductivity, and dynamic moduelectrical resistivity and conductivity, and dynamic modulus of elasticity. This alloy has the proper combination of strength properties, ductility, and stress-corrosion resistance to make its use advantageous for unfired pressure vessel applications at temperatures up to 850-900 F.

Al_2-Clad UO_2 Ceramics for Nuclear-Fuel Applications. A. K. Smalley, W. C. Riley, and W. H. Duckworth. *American Ceramic Society*, Bulletin, v. 39, July 1960, p. 359-361.

A ceramic nuclear fuel consisting of a UO_2 score clad with dense Al_2O_3 was prepared in the laboratory. Processing involved the use of a special sinterable powder form of high-purity Al_2O_3. This powder was applied to unsintered UO_2 pellets by a spraying-tumbling technique followed by isostatic pressing, and sintering in hydrogen. There was no measurable release of fission products from irradiated clad particles heat treated at 1700 F in vacum for seven days after exposure to a 6.0×10^{12} nv for 1 hr at room temperature. Sound claddings of other oxides, e.g., BeO or MgO, probably could be applied by the same technique.

Component-Part Screening Procedures Based on Multiparameter Measurements. Ralph E. Thomas. *IRE Transactions on Component Parts*, v. CP-6, no. 4, December, 1960, pp. 252-258.

A screening methodology based on measurements of several parameters is proposed. The methodology provides an improved semiquantitative basis for the selection and evaluation of screening criteria. The methodology is based on a combination of standard statistical techniques, and is novel only in maintaining a tractable analysis of the over-all problem of screening individual component parts by variables inspection.

A Study of the Effects of Fabricating Conditions on Some Properties of Sintered Uranium Monocarbide. Arch B. Tripler, Jr., M. Jack Snyder, and Winston H. Duckworth. U. S. Atomic Energy Commission, BMI-1383, October 2, 1959, pp. 12. (OTS $0.75)

Effect of initial particle size (6.2 and 14.7μ), forming pressure (50,000 and 100,000 psi), temperature (1600 and 1800 C), and time at temperature (1 and 3 hr) on the bulk density, grain size, and porosity of sintered uranium monocarbide compacts was studied. There appeared to be no significant changes in these properties of the sintered material attributable to the changes in the fabricating conditions.

Individual Creativity in Research. Lewis E. Walkup. *Nondestructive Testing*, v. 18, no. 4, July-Aug. 1960, p. 236 + 5 pages.

The ability to think creatively is a quality possessed by many unusual individuals. The author stoutly maintains, however, that most persons can increase their creativity quotient. Suggestions for improving individual creative qualities are presented.

Research and Development of Procedures for Joining of Similar and Dissimilar Heat-Resisting Alloys by Ultrasonic Welding. Norman E. Weare, John N. Antonevich, and others. *Report for July, 1957-June 1958* on Metallic Materials, Contract AF 33(616)-5342, February, 1959, pp. 83. WADC Technical Report No. 58-479; AD-208 323. (PB 145 015; LC mi $4.80, ph $13.80)

Metallographic examinations of the heat-resistant weldments showed the presence of cracks at the edges of many of the spot welds. Methods of preventing such cracking can probably be determined. Efforts in the fundamental studies were aimed at studying the mechanism of bonding by ultrasonic welding.

Difffusion of Copper into AlSb. R. H. Wieber, H. C. Gorton, and C. S. Peet. *Journal of Applied Physics*, v. 31, Mar. 1960, p. 608.

Studies were made in the temperature range from 150 C to 500 C by radio tracer techniques. The extremely rapid diffusion rate of copper into AlSb not only precludes the use of copper as a dopant in the formation of p-n junctions for high temperatures operation, but also points up the extreme care that must be taken to avoid copper contamination during the processing of AlSb crystals for device application.

A Replica Method for Examining Wear and Scuffing in Cylinder Liners. A. P. Young and C. M. Schwartz. *Wear*, v. 3, no. 3, May-June 1960, p. 235-240.

For the purpose of periodic inspection of cylinder liners during an engine test, a nondestructive method of examination had to be devised. Previous experience with replica methods indicated that plastics replicas could be used for the proposed examination of cylinder liners. The details of preparation and examination of the replicas of cylinder liners are described. It is apparent from the micrographs that replicas can be used to follow the progress of wear in cylinder liners or in any other bearing surfaces which can be rendered accessible to replication. Gold evaporation on the surface enhances the contrast for photomicrography and in this instance was helpful for locating the same areas in successive steps. For many purposes the replicas can be examined by vertical illumination without metal shadowing.

Measurement of Pressure Effect on the Seebeck Coefficient of Powder Compacts. A. P. Young, P. B. Robbins, W. B. Wilson, and C. M. Schwartz. *Review of Scientific Instruments*, v. 31, Jan. 1960, p. 70-71.

At pressures up to 20,000 atm, the sample resistance, and in some materials the thermoelectric voltage, are dependent in part on degree of compaction. At higher pressures there may still be some irreversible effects on resistivity and thermoelectric voltage probably due to nonhydrostatic stresses on the sample. Work is in progress to determine the effects of pressure on electrical properties of several metal oxides, and an effort is being made to separate reversible and irreversible effects.

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ADMINISTRATION AND PHILOSOPHY OF RESEARCH

9813* Impact of Society on Science. The author gives examples, particularly from Eastern countries, where society has inhibited scientific thought and indicates that such social effects can still limit scientific development today. ***P. Parija.*** *Journal of Scientific & Industrial Research*, v. 19A, Jan. 1960, p. 3-7.

9814* The Basic Resources of Research. The basic resources needed for industrial research are scientific manpower, fundamental scientific knowledge, and capital. These resources and their relationship to industrial research in the United States are discussed. ***Raoul J. Freeman.*** *Research Management*, v. 3, no. 1, Spring 1960, p. 13-25.

9815* Poliomyelitis Vaccine: A Story of Its Development. In 1949 a research group headed by Dr. John Enders described the successful cultivation of the virus of poliomyelitis in test tube cultures of living cells obtained from monkey kidneys. Early in 1953 Dr. Jonas Salk presented the results of his investigations on an experimental vaccine and an outline of a formaldehyde inactivation process. ***Fred D. Stimpert, I. W. McLean, Jr., and B. I. Wilner.*** *Research Management*, v. 3, no. 1, Spring 1960, p. 27-38.

9816* Introduction of the Newly Graduated Scientist to Industrial Research. In the final analysis the challenge to industrial research management is that of actually providing job situations in which the maximum potential of the research scientist is constantly realized in areas of mutual interests. Above all, it is essential that what management preaches and what it practices should result in as few discrepancies as possible. ***E. M. Kipp.*** *Research Management*, v. 3, no. 1, Spring 1960, p. 39-47.

9817* Sustaining Creativity Against Organizational Pressures. The Shell Companies Laboratories in the U. S. have been successful in maintaining environments in which creativity can flourish. ***Harold Gershinowitz.*** *Research Management*, v. 3, no. 1, Spring 1960, p. 49-56.

9818* Motivating the Industrial Research Scientist. Recommends providing a climate which least inhibits the self-motivation of a research scientist. ***Horace A. Secrist.*** *Research Management*, v. 3, no. 1, Spring 1960, p. 57-64.

9819 Scientific Manpower 1958. Papers of the Seventh Conference on Scientific Manpower and Symposium on Demographic and Sociological Aspects of Scientific Manpower. 87 pp. 1958. National Science Foundation, Washington, D. C. (Q147.U5 N21s)

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

9820 Aerodynamic Instability of Supersonic Inlet Diffusers. The stability problem of supersonic inlet diffusers is first reduced to find the acoustic impedance at the inlet of the plenum chamber. ***Chieh-Chien Chang and Cheng-Ting Hsu.*** *ARS Journal*, v. 30, May 1960, p. 468-475.

9821 Satellite Pressure Losses Caused by Meteoroid Impacts. In order to predict the frequency of hull penetration of a satellite capsule by meteoroids, estimates are made of the frequency of encounters with meteoroids, and the cratering effect of each impact. The cratering effects are based on the correlation of recent laboratory experimentation using hypervelocity particles, and very conservative estimates of impact frequency are employed. ***M. Kornhauser.*** *ARS Journal*, v. 30, May 1960, p. 475-479.

9822 Solar Heating of a Rotating Cylindrical Space Vehicle. Solar heating in a space vehicle idealized as a thin walled circular cylinder rotating with uniform velocity about its geometric axis is studied for a situation in which heat transfer

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by convection and heat exchange within the cylinder is negligible. The nonlinear problem is approximated through a perturbation analysis and detailed estimates are made of the parameters of interest for various ranges of speed of rotation. ***A. Charnes and S. Raynor.*** *ARS Journal*, v. 30, May 1960, p. 479-484.

9823 Note on the Assessment of Flow Disturbances at a Blunt Body Traveling at Supersonic Speeds Owing to Flow Disturbances in Free Stream. For the purposes of assessing the magnitude of flow disturbances which would affect conditions on a blunt nose of a body moving at supersonic speeds, the detached shock is approximated by a purely normal shock. The disturbances downstream of the shock are expressed in terms of the "free-stream" disturbances by considering sinusoidal fluctuations. ***M. V. Morkovin.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 223-229.

9824 Possible Similarity Solutions for Laminar Free Convection on Vertical Plates and Cylinders. A study is made of the unsteady laminar boundary-layer equations for free convection on vertical plates and cylinders to establish necessary and sufficient conditions under which similarity solutions are possible. On the basis of these conditions, all possible cases are derived, including those for unsteady conditions. ***Kwang-Tzu Yang.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 230-236.

9825 Heat Transfer for Laminar Flow in Ducts With Arbitrary Time Variations in Wall Temperature. An analysis is made for laminar forced-convection heat transfer in a circular tube or a parallel plate channel whose walls may undergo arbitrary time variations in temperature. The greater part of the analysis is concerned with the response to a step change in wall temperature, and the time required to reach steady state is given for this type of transient. ***Robert Siegel.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 241-249.

9826 An Approximate Analysis of the Influence of Aerodynamic Heating and Initial Twist on the Torsional Stiffness of Thin Wings. Approximate formulas are derived, based on the "fiber-stress" concept for the combined influence of aerodynamic heating and initial twist on the torsional stiffness of a thin wing. ***Lit S. Han.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 332-334.

9827 The Long-Time Satellite Rendezvous Trajectory. Describes a method of achieving rendezvous with a satellite which is in a circular orbit. Steering equations are given which express the desired velocity as a function of position and time. ***Louis W. Spradlin.*** *Aero/Space Engineering*, v. 19, June 1960, p. 32-37.

9828 Helicopters and VTOL Aircraft. Criteria for Control and Response Characteristics in Hovering and Low-Speed Flight. ***Robert J. Tapscott.*** *Aero/Space Engineering*, v. 19, June 1960, p. 38-41.

9829 Tangent Force in the Flow Along a Flat Plate. Measurements were carried out in a wind tunnel along a flat plate with a zero pressure gradient. (*In Italian.*) Tensione Tangenziale nel flusso lungo una lastra piana. ***Ennio Mattioli.*** *Aerotechnica*, v. 39, no. 6, Dec. 1959, p. 290-294.

9830 Key Equipment for Tiros I. The Tiros I complex of instruments and control devices, described here, has proved itself for first-generation vehicles, and will provide a firmer base for future satellite and instrument designs. ***E. A. Goldberg and V. D. Landon.*** *Astronautics*, v. 5, June 1960, p. 36 + 3 pages.

9831 Thermal Design for Tiros. How the heat-balance problem for this satellite was solved by appropriate analysis, materials development, and lab testing. ***Milton Ritter.*** *Astronautics*, v. 5, June 1960, p. 40 + 4 pages.

9832* The Development of the STOL Airplane. Within the next ten years the STOL airplane will share the limelight with the more spectacular high speed jet transport. ***A. F. MacDonald.*** *Canadian Aeronautical Journal*, v. 6, no. 6, June 1960, p. 203-206.

9833* The Design and Testing of an Air Intake for a Small Shaft Power Gas Turbine. Three-dimensional electrolytic tank tests were used to predict a proper side wall profile for an axially symmetric intake to be used with a small shaft power gas turbine. The wall velocity profiles plotted nondimensionally indicated little or no Mach number effect. ***J. H. T. Wade.*** *Canadian Aeronautical Journal*, v. 6, no. 6, June 1960, p. 207-212.

9834* New Problem Areas in Aircraft Propeller Design. A brief review is presented of the advances in aircraft propeller design from the trial-and-error art of the early years, of fixed pitch and ground adjustable propellers, to the precise aerodynamic and structural design of propellers for today's high performance aircraft. ***G. Rosen.*** *Canadian Aeronautical Journal*, v. 6, no. 6, June 1960, p. 213-220.

9835 Weather-Test Thor IRBM in Environmental Chamber. Simulating weather conditions ranging from an Arctic gale to a rainstorm in the tropics, the world's largest environmental test chamber for rockets puts the Thor IRBM through actual launching conditions met anywhere in the world without the missile ever leaving the ground. ***Herbert H. Christman.*** *Heating, Piping & Air Conditioning*, v. 32, June 1960, p. 123-127.

9836 An Investigation of Laminar, Transitional, and Turbulent Heat Transfer on Blunt-Nosed Bodies in Hypersonic Flow. Heating rates were measured by means of the shrouded model technique. The experimental data are compared to the laminar hypersonic boundary-layer theory and shown to be in good agreement on the conical portion of the model. On the spherical portion the data are approximately 20% higher than the theoretical prediction. Some of this discrepancy can be attributed to radiation to the nose of the model. ***Robert J. Cresci, Donald A. MacKenzie, and Paul A. Libby.*** *Journal of the Aero/Space Sciences*, v. 27, June 1960, p. 401-414.

9837 A Study of Spray Generated by Seaplane Hulls. The mechanism of spray generated by seaplane hulls is explained by the same physical conception as in the slender body theory of aerodynamics. ***Shizuo Kikuhara.*** *Journal of the Aero/Space Sciences*, v. 27, June 1960, p. 415-428.

9838 Supersonic Inlet Dynamics. An approximation of the differential equation for compressible duct flow is presented. The equation is linear and of the second order. ***H. R. Fraiser.*** *Journal of the Aero/Space Sciences*, v. 27, June 1960, p. 429-436.

9839 Theory of Supersonic-Propeller Aerodynamics. A supersonic propeller with blades attached to an infinite cylinder as a hub is studied. The forward speed may be subsonic, but the relative speed at each section is supersonic. Tip effects are considered by extending the theory of Evvard and Krasilshchikova. The present investigation, however, is restricted to those planforms for which no vortex sheet appears off the tip. ***Donald Earl Ordway and Richard W. Hale.*** *Journal of the Aero/Space Sciences*, v. 27, June 1960, p. 437-450.

9840 Oscillatory Aerodynamic Coefficients for a Unified Supersonic-Hypersonic Strip Theory. Presents a derivation of the oscillatory aerodynamic coefficients for wings with supersonic leading edges from the second-order, nonlinear, unsteady, supersonic flow theory of Van Dyke. ***William P. Rodden and James D. Revell.*** *Journal of the Aero/Space Sciences*, v. 27, June 1960, p. 451-459.

9841 A Summary of Design Techniques for Axisymmetric Hypersonic Wind Tunnels. A family of perfect fluid coordinates for axisymmetric effusers with the exit Mach number range of 5 to 20 was computed by the method of characteristics. A conical source flow front and a centerline Mach number distribution are used as initial conditions. Design techniques and other related problems of interest in the development of hypersonic facilities are summarized. ***Ying-Nien Yu.*** *North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development, Agardograph* 35, Nov. 1958, 88 pages + Appendices. (TL565 Ag11g Contin.)

9842* A Solution of the Compressible Laminar Boundary Layer Equations With Heat Transfer and Adverse Pressure Gradient. ***G. Poots.*** *Quarterly Journal of Mechanics and Applied Mathematics*, v. 13, pt. 1, Feb. 1960, p. 57-84.

9843 Study of the Aerodynamic Forces and Moments on Bodies of Revolution in Combined Pitching and Yawing Motions. Significant errors are pointed out in the accepted

practice of writing the aerodynamic forces and moments that act on a body of revolution during pitching and yawing motion. A more correct formulation is presented which shows that, even with linear aerodynamic coefficients, the differential equations governing the motion are fundamentally nonlinear. This permits an explanation of certain types of motion which have been observed experimentally and which have been explainable previously only with the assumption of nonlinear aerodynamic characteristics. ***Murray Tobak and Henry C. Lessing.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-316, May 1960, 24 pp. (TL570 Un3t Vis.)

9844 An Experimental Investigation of the Effect of Wind Tunnel Walls on the Aerodynamic Performance of a Helicopter Rotor. Experimental tests were made to determine the range of advance ratio and blade angle in which wind-tunnel wall corrections as developed for wings might be used for helicopter rotors. Lift and drag coefficient data were corrected by standard wing-type wall corrections using the full span of the rotor as the vortex span and the area of the rotor disk as the wing area. Data from three test section sizes were compared to determine at which blade angles and advance ratios the wind-tunnel wall corrections gave satisfactory agreement. ***Victor M. Ganzer and William H. Rae, Jr.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-415, May 1960, 35 pp. (TL570 Un3t Vis.)

9845 Effect of Body Perturbations on Hypersonic Flow Over Slender Power Law Bodies. The perturbation equations formulated can be used for a variety of problems. In particular, the effect of boundary-layer development, very small angles of attack, and nose blunting can be found. Differential equations for finding the effect of a power law lateral perturbation of the centerline of a slender power law body are derived. ***Harold Mirels and Philip R. Thornton.*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR*-R-45, 1959, 30 pp. (TL521 Un3ra Vis.)

9846 Second-Order Slender-Body Theory—Axisymmetric Flow. Slender-body theory for subsonic and supersonic flow past bodies of revolution is extended to a second appoximation. Methods are developed for handling the difficulties that arise at round ends. ***Milton D. Van Dyke.*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR*-R-47, 1959, 26 pp. (TL521 Un3ra Vis.)

9847 Approximations for the Thermodynamic and Transport Properties of High-Temperature Air. Compressibility, enthalpy, entropy, specific heats, speed of sound, coefficients of viscosity and of thermal conductivity, and Prandtl numbers for air are tabulated from 500 to 15,000 K over a range of pressure from 0.0001 to 100 atmospheres. ***C. Frederick Hansen.*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR*-R-50, 1959, 35 pp. (TL521 Un3ra Vis.)

See also: **10488** (aircraft gas turbine lubricants).

AGRICULTURE

9848 Production of Hay Wafers. A review of progress in developing wafer-making equipment. ***John B. Dobie.*** *Agricultural Engineering*, v. 41, June 1960, p. 366-369.

9849* What's New in Chemurgy. *K. Starr Chester.* *Chemurgic Digest*, v. 19, Apr. 1960, p. 6-9.

9850* Immunological Studies on *Dictyocaulus viviparus* Infection—Immunity Produced by the Administration of Irradiated Larvae. Experiments are described on the immunity to lung worm infection produced by the administration of 3rd stage *D. viviparus* larvae partially inactivated by X-irradiation. A high degree of immunity was obtained by this method. ***W. F. H. Jarrett, F. W. Jennings, W. I. M. McIntyre, W. Mulligan, and G. M. Urquhart.*** *Immunology*, v. 3, no. 2, Apr. 1960, p. 145-151.

9851 Determination of Heptachlor Epoxide in Fat and Milk. ***Charles F. Meyer, Marshall A. Malina, and Percy B. Polen.*** *Journal of Agricultural and Food Chemistry*, v. 8, May-June 1960, p. 183-186.

BIOCHEMISTRY AND BIOPHYSICS

9852* Recent Advances in the Chemotherapy of Infection. ***Louis Weinstein.*** *A.M.A. Archives of Industrial Health*, v. 21, no. 6, June 1960, p. 487-502.

9853* Experimental Applications of Bone Marrow Transplantation. ***C. C. Congdon and Alexander Hollaender.*** *AMA Archives of Pathology*, v. 69, June 1960, p. 605-612.

9854* The Reaction of Nitrous Acid With Deoxyribonucleic Acid. The similar reaction velocities of the bases of DNA within bacterial cells and those of thymus DNA in solution indicate that the HNO_2 molecules can react with the DNA within intact cells without inhibitory influence by the surrounding cell constituents. ***H. Schuster.*** *Biochemical and Biophysical Research Communications*, v. 2, no. 5, May 1960, p. 320-323.

9855* The Base Specificity of Mutation Induced by Nitrous Acid in Phage T2. The deamination rate, a, of both A and C decreases by a factor of about 90 from pH 4.20 to pH 5.00, whereas the deamination rate of G decreases by a factor of only 35. It is concluded that the deamination of mainly A, C or both, but not of G, is responsible for the induction of mutations. ***W. Vielmetter and H. Schuster.*** *Biochemical and Biophysical Research Communications*, v. 2, no. 5, May 1960, p. 324-328.

9856* Studies on the Organization of Nucleic Acids Within Nucleoproteins. Unless we make the assumption that large changes in ultraviolet absorbance might be caused by base-protein interaction, it can be concluded that the nucleic acids from 80 S particles, T6, and SPV are packed in the intact particles in a manner involving base-base interaction to the same degree as found for the isolated nucleic acids. ***F. Bonhoeffer and H. K. Schachman.*** *Biochemical and Biophysical Research Communications*, v. 2, no. 5, May 1960, p. 366-371.

9857* The Organization and Replication of Deoxyribonucleic Acid in Thymine-Deficient Strains of *Escherichia coli*. An autoradiographic study of the distribution of incorporated [^{3}H] thymidine among the progeny of cells of the thymine-requiring strains of *Escherichia coli*, 15T- and B-3, has been made. The distributions are markedly heterogeneous and are characterized by the presence of a small number of cells containing most of the label. Experiments with *E. coli* 15T- exposed to label for less than one division time are interpreted as revealing the presence in this organism of two large DNA-containing structures. ***Frederick Forro, Jr. and Stephen A. Wertheimer.*** *Biochimica et Biophysica Acta*, v. 40, no. 1, May 6, 1960, p. 9-21.

9858* Some Consequences of the Application of the Second Law of Thermodynamics to Cellular Systems. Entropy changes accompanying cell division are discussed and expressions for these are formulated. The entropy changes are summed and the limitation of the second law ($\Delta S > 0$) is imposed. From the resulting inequality the minimum amount of waste material accompanying cellular synthesis is computed. In addition certain conclusions are drawn as to the maximum rate of cell division. ***Harold J. Morowitz.*** *Biochimica et Biophysica Acta*, v. 40, no. 2, May 20, 1960, p. 340-345.

9859* Isolation of "Soluble RNA" Without an Ultracentrifuge. Easy bulk preparation of biologically active ribonucleic acids is possible without the necessity of the slow ultracentrifugation technique which can result in the isolation of a partially degraded product. ***Kendric C. Smith.*** *Biochimica et Biophysica Acta*, v. 40, no. 2, May 20, 1960, p. 360-361.

9860* Chloramphenicol, Nucleic Acid Synthesis and Mutation Induced by Ultraviolet Light. The acquisition of the capacity to synthesize DNA rather than DNA synthesis is involved in "mutation fixation". Following u.v. exposure, the synthesis of RNA and proteins endows the bacterium with the capacity both for DNA synthesis and mutation induction. ***C. O. Doudney and F. L. Haas.*** *Biochimica et Biophysica Acta*, v. 40, no. 2, May 20, 1960, p. 375-377.

9861* Models for the Interpretation of Experiments Using Tracer Compounds. ***Jerome Cornfield, Jesse Steinfeld, and Samuel W. Greenhouse.*** *Biometrics*, v. 16, no. 2, June 1960, p. 212-234.

9862* The Minor Components of Normal Human Adult Haemoglobin. ***W. B. Gratzer and G. H. Beaven.*** *British Journal of Haematology*, v. 6, no. 2, Apr. 1960, p. 191-197 + 1 plate.

9863* Allocycly of the X-Chromosome in Tumors and Normal Tissues. A single, deeply staining heteropyknotic chromosome, most conspicuous during prophase in neoplastic and normal diploid female cells of mouse and rat, is interpreted as one of the two X-chromosomes. Tetraploid female nuclei often contain two such elements, tetraploid male nuclei only one. ***S. Ohno and T. S. Hauschka.*** *Cancer Research*, v. 20, no. 4, May 1960, p. 541-545.

9864* Immunochemical Studies of Organ and Tumor Lipides. VII. The Reactivity of Anti-Human Tumor Sera With Cytolipin H, Cardiolipin, and Forssman Haptens. Anti-human tumor sera containing antibodies directed against lipide have been studied for their reactions with cytolipin H and cardiolipin, and their relative content of Forssman antibody. Antibodies reacting with cytolipin H are present most frequently and probably account for a major portion of the reactivity with most extracts of tissue lipides. Antibodies reacting with cardiolipin and Forssman hapten may also be present, so that each antiserum exhibits an individual pattern of reactivity. ***Liselotte Graf and Maurice M. Rapport.*** *Cancer Research*, v. 20, no. 4, May 1960, p. 546-550.

9865 Enzymatic Fungicides Show Promise. Chitinase destroys tough cell wall, exposes protoplast to the air. . . . It leaves no toxic residue and has no harmful effect on plants. *Chemical and Engineering News*, v. 38, no. 22, May 30, 1960, p. 42-43.

9866* RNA and DNA Metabolism in Human Tissue Culture Cells Studied With Tritiated Cytidine. Experimental results lend support to the hypothesis that RNA synthesis begins in the chromatin portion of the nucleus. The fate of the incorporated cytidine apparently is decided in the nucleus, where it is first linked specifically and from where it progresses to the building blocks of nucleolar and cytoplasmic RNA or DNA. ***L. E. Feinendegen, V. P. Bond, W. W. Shreeve, and R. B. Painter.*** *Experimental Cell Research*, v. 19, no. 3, Apr. 1960, p. 443-459.

9867* Chromosomal Pattern in Some Mouse Ascites Tumours After Deep Freezing. Five different lines of Ehrlich's near tetraploid mouse ascites cancer with different chromosome patterns and chromosome morphology as well as one line of Landschütz diploid mouse ascites cancer were studied for any reaction to a long period of deep freezing. In none of the cancers was deep freezing found to have any effect on the mean number of chromosomes per cell or on the distribution of the cells according to chromosome number. During the first passage of the tumors after deep freezing they usually showed a somewhat lower rate of growth, but during the subsequent passages the rate of growth was identical with that before freezing. No change was observed in the heterologous transplantability of the tumors. ***Ulla Ising.*** *Experimental Cell Research*, v. 19, no. 3, Apr. 1960, p. 475-488.

9868* On Isopycnotic Behavior of the XX-Bivalent in Oocytes of *Rattus norvegicus*. The invariable end-to-end association of the positively heteropycnotic X- and Y-chromosomes during male meiosis may be the direct consequence of the evolved mechanism by which the almost complete isolation of the female-determining chromosomes from the male-determining chromosome has been preserved. The normal rate of crossing over between the two female-determining chromosomes, on the other hand, does not impair the established mechanism of sex determination. Present findings of the XX-bivalent and previous findings on the sex chromosomes in somatic cells of this species have shown that as far as the sex chromosomes are concerned, the manifestation of a positively heteropycnotic condition is not a *sine qua non* of heterochromatic regions. ***S. Ohno, W. D. Kaplan, and R. Kinosita.*** *Experimental Cell Research*, v. 19, no. 3, Apr. 1960, p. 637-639.

9869* Studies on the Transfer of Antibody-Producing Capacity. II. The Serial Transfer of Antibody-Producing Cells. If spleen cells were not antigenically stimulated *in vitro*, they formed comparatively small quantities of antibody, and successful passage could only be achieved for two or three passages. If spleen cells were antigenically stimulated before passage, much more antibody was produced, and successful passage could be achieved for five passages. Moreover, if the donor animal had been immunized with two unrelated antigens, and the spleen cells before passage were stimulated with one antigen but not the other, the hosts developed far more antibody to the former than to the latter. ***G. J. V. Nossal.*** *Immunology*, v. 3, no. 2, Apr. 1960, p. 109-116.

9870 Origin of Deoxyribonucleic Acid of the Bacterial Endospore. Endospores of *Bacillus megaterium* and *Bacillus cereus* formed under conditions of endotrophic sporulation have less than one half the phosphorus of deoxyribonucleic acid of the vegetative cell. ***Phillip H. Hodson and Jay V. Beck.*** *Journal of Bacteriology*, v. 79, no. 5, May 1960, p. 661-665.

9871* Propagation of Certain Arthropod-Borne Viruses in Avian and Primate Cell Cultures. In general, group A viruses were found to multiply in both avian (chick embryo and Pekin duck kidney or embryo) and the primate (rhesus monkey kidney) cell systems with few exceptions. Group B viruses could be propagated in Pekin duck kidney or Pekin duck embryo cultures, but not in chick embryo or rhesus monkey kidney (except Ilheus), and the group C viruses produced plaques only in rhesus monkey kidney cell cultures. ***J. R. Henderson and R. M. Taylor.*** *Journal of Immunology*, v. 84, no. 6, June 1960, p. 590-598.

9872* A Proposed Standard System of Nomenclature of Human Mitotic Chromosomes. A statement has been drawn up by a study group, which met to formulate an agreed system of nomenclature for human chromosomes, with a view to eliminating the confusion which has arisen from the independent publication of a variety of systems by different workers. ***J. A. Böök, et al.*** *Lancet*, no. 7133, May 14, 1960, p. 1063-1065.

9873* New Antiviral Chemotherapeutic Agent Active Against Smallpox Infection. Infant mice infected intracerebrally with 100 $L.D._{50}$ of alastrim virus could be protected against death and the development of encephalitis by treatment with N-ethylisatin β-thiosemicarbazone at a dose level of 5 mg. per kg. The antiviral chemotherapeutic activity found in animal experiments is thus high enough to suggest that N-ethylisatin β-thiosemicarbazone may be of value in the specific treatment of smallpox in man. ***D. J. Bauer and P. W. Sadler.*** *Lancet*, no. 7134, May 21, 1960, p. 1110-1111.

9874* Abnormalities Involving the X Chromosome in Women. ***D. G. Harnden, et al.*** *Lancet*, no. 7136, June 4, 1960, p. 1213-1216.

9875 Methods of Biochemical Analysis. ***David Glick, editor.*** v. VIII. 400 pp. 1960. Interscience Publishers, Inc., New York. (QP519 M56 Vis.)

9876* Gene Structure and Function in Neurospora. ***R. P. Wagner, Carolyn E. Somers, and Arloa Bergquist.*** *National Academy of Sciences, Proceedings*, v. 46, May 1960, p. 708-717.

9877* Evidence for the Existence of a Single-Stranded Stage of T2 Bacteriophage During Replication. T2r$^+$ and T2r+ *E. coli* B complexes at different times in the latent period have been irradiated with monochromatic ultraviolet light at different wavelengths. The action spectrum for the phage alone shows a minimum at about 2,350 Å. The shape of the action spectrum remains constant until three min after injection, at which time the minimum shifts to 2,400 Å. The minimum is again seen at 2,350 Å eleven min after injection. These shifts in the action spectrum are interpreted as a change in viral DNA from a double-stranded to a single-stranded configuration at three min and back to a double-stranded state by eleven min. ***Jane K. Setlow and Richard B. Setlow.*** *National Academy of Science, Proceedings*, v. 46, June 1960, p. 791-798.

9878* Partial Purification of Soluble RNA. ***Paul C. Zamecnik, Mary L. Stephenson, and Jesse F. Scott.*** *National Academy of Sciences, Proceedings*, v. 46, June 1960, p. 811-822.

9879 The Natural Pigments. Includes the pyran, pyrrole, pyrimidine, quinonoid, and polyene pigments. ***K. W. Bentley.*** v. IV. 306 pp. 1960. Interscience Publishers, Inc., New York. (QP671 B44n)

9880 Thermodynamics and Kinetics of Spontaneous Generation. ***J. D. Bernal.*** *Nature,* v. 186, May 28, 1960, p. 693-695.

9881 Flow of Blood Through Narrow Tubes. ***G. W. Scott Blair.*** *Nature,* v. 186, May 28, 1960, p. 708-709.

9882 A Possible Basis for Immunological Tolerance. ***D. T. Denhardt.*** *Nature,* v. 186, May 28, 1960, p. 728-729.

9883 A New Electrophoretic Medium and Its Application to the Resolution of Human Haemoglobin Variants. ***E. R. Huehns and A. O. Jakubovic.*** *Nature,* v. 186, May 28, 1960, p. 729-730.

9884 Triploid Rat Embryos and Other Chromosomal Deviants After Colchicine Treatment and Polysperm. Dispermic fertilization is a source of triploid embryos in the rat. It seems that most dispermic triploid embryos can become implanted and their further fate does not differ considerably from that of triploids of other origin. Colchicine treatment after ovulation is an efficient method to induce heteroploidy in the rat; but few heteroploid embryos survive to mid-term. A large proportion of the heteroploid forms (including most triploids) die before or soon after implantation. ***L. Piko and O. Bomsel-Helmreich.*** *Nature,* v. 186, May 28, 1960, p. 737-739.

9885 Fractionation of Genes. A study of human dwarfism. ***R. Ruggles Gates.*** *Nature,* v. 186, May 28, 1960, p. 739-740.

9886* Synthetic Polyelectrolytes as Tumor Inhibitors. Tumor inhibition by polyelectrolytes may be a function of charge-density and distribution on the polyelectrolyte molecule. The inactivity of the monomeric fragments tested indicates the necessity for the polymeric structure. Synthetic polyelectrolytes not only inhibit transplanted tumors but also certain vital enzymes such as ribonuclease and deoxyribonuclease. ***William Regelson, et al.*** *Nature,* v. 186, June 4, 1960, p. 778-780.

9887* Experiments on Pekin Ducks Treated With DNA From Khaki Campbell Ducks. Unexpected modifications were observed in 9 to 12 ducks treated with DNA, while 24 controls did not show any abnormality. The modified animals transmitted their new characteristics to their progeny as far as the third generation. ***J. Benoit, P. Leroy, R. Vendrely, and C. Vendrely.*** *New York Academy of Sciences, Transactions,* v. 22, no. 7, May 1960, p. 494-503.

9888* A Biological Problem of Paramount Importance. Report on the conference on nucleic acids held in Dec., 1954, in Moscow and covering such subjects as the biosynthesis of nucleic acids, genetic transformation, ionizing irradiations and nucleic acids, and advanced studies of the cell. (*In Russian.*) Vazhneishaia problema biologii. ***S. M. Gershenzon and I. P. Kok.*** *Priroda,* v. 9, no. 5, May 1960, p. 54-56.

9889* Mechanism of Viral Invasion. ***Lloyd M. Kozloff.*** *Record of Chemical Progress,* v. 21, no. 1, Mar. 1960, p. 49-63.

9890 Biologic Synthesis of Deoxyribonucleic Acid. This article is adapted from the author's Nobel lecture presented in Stockholm, December, 1959. ***Arthur Kornberg.*** *Science,* v. 131, May 20, 1960, p. 1503-1508.

9891 The Effect of Dream Deprivation. Results are tentatively interpreted as indicating that a certain amount of dreaming each night is a necessity. A pressure to dream builds up with the accruing dream deficit during successive dream-deprivation nights—a pressure which is first evident in the increasing frequency of attempts to dream and then, during the recovery period, in the marked increase in total dream time and percentage of dream time. The fact that this increase may be maintained over four or more successive recovery nights suggest that there is a more or less quantitative compensation for the deficit. ***William Dement.*** *Science,* v. 131, June 10, 1960, p. 1705-1707.

9892* Organoleptic Quality and the Stereochemical Theory of Olfaction. ***James W. Johnston, Jr. and Armando Sandoval.*** *Toilet Goods Association, Proceedings of the Scientific Section,* no. 33, May 1960, p. 3-9.

9893* On the Tasks Concerning Investigation of the Problem "The Main Questions of Cytology". A review of the problems considered as basic for Soviet cytological research during the current seven years, such as the reproduction of cells and cellular structures, cell permeability, irritability, specialized cellular functions, the cytology of unicellular and lower multicellular organisms of the animal and vegetal kingdoms. (*In Russian.*) O zadachaky issledovaniĭ po probleme "uzlovye voprosy tsitologii". ***A. S. Troshin.*** *TSitologiia,* v. 2, no. 2, Mar.-Apr. 1960, p. 131-137.

9894* Effect of Free Cystein on the Irradiated Suspension of the Yeast Cells. Free cystein addition to an aqueous suspension of yeast cells at different intervals before irradiation (within two hours) does not change its protective effect. A higher cystein concentration (10^{-5} gM/ml) added immediately after irradiation to the active cell culture, has a healing effect on the disease of the fission. (*In Russian.*) Vliianie svobodnogo tsisteina na obluchennuiu suspenziiu drozhzhevykh kletok. ***V. N. Benevolenskiĭ.*** *TSitologiia,* v. 2, no. 2, Mar.-Apr. 1960, p. 170-174.

9895* Studies *In Vitro, In Vivo,* and by Electron Microscope of a Virus Recovered From a C3H Mouse Mammary Tumor: Relationship to Polyoma Virus. The virus recovered from the C3H mammary carcinoma belongs to the polyoma family. However, it is less carcinogenic for mice and more carcinogenic for hamsters and rats than the polyoma virus recovered by Eddy Stewart, et al. ***A. F. Howatson, et al.*** *U. S. National Cancer Institute, Journal,* v. 24, no. 5, May 1960, p. 1131-1151.

9896* An Oligonucleotide Mapping Procedure and Its Use in the Study of Tobacco Mosaic Virus Nucleic Acid. A two-dimensional procedure was developed employing paper electrophoresis and paper chromatography, which permitted the separation and identification of all major products obtained by digestion of tobacco mosaic virus ribonucleic acid (TMV-RNA) with pancreatic ribonuclease. The map so obtained showed nineteen spots accounting for approximately 90% of the optical density of the material applied. The substances in the major spots were quantitatively estimated by elution and spectrophotometry, and qualitatively identified by application of standard procedures for determining the composition of nucleotides and oligonucleotides. ***G. W. Rushizky and C. A. Knight.*** *Virology,* v. 11, no. 1, May 1960, p. 236-249.

9897* Transduction of Chromosomal Genes and Episomes in *Escherichia coli*. ***Werner Arber.*** *Virology,* v. 11, no. 1, May 1960, p. 273-288.

9898* Ethylene—An Endogenous Metabolite in Tumour-Bearing Animals. Concentrations of ethylene as low as $1:10^{6}$-$1:10^{9}$ can be estimated by biological assay with etiolated sprouts of Vicia sativa. It was shown that albino rats and swine ascarids, like plants and fungi, produce ethylene. Tumor-bearing rats (transplantable sarcoma M-1) produce greater amounts of ethylene than healthy animals. The endogenous formation of ethylene in the animal body, as in plants, is autocatalytic. The ultraviolet irradiation inhibits ethylene formation in rats. (*In Russian.*) Etilen - endogennoe veshchestvo u opukholenositeleĭ. ***M. T. Kokonov.*** *Voprosy Meditsinskoĭ Khimii,* v. 6, no. 2, Mar.-Apr. 1960, p. 158-165.

9899* The First Conference on Nucleic Acids and Nucleoproteins. The following were among the many reports presented at this conference held Dec. 21-24, 1959, in Moscow: Problem of the specificity of nucleic acids, biological value of DNA, immunological properties of DNA and RNA, mutual connection of the biosynthesis of nucleic acids and nucleotides, statistical theory of polycondensation of DNA, structural disturbances of native DNA during radiation of its solutions by means of CO^{60} rays, effects of nucleic acids on the inclusion of amino acids and on the change of the amount of the peptide links in the "protein-amino acid" system. (*In Russian.*) Pervaia konferentsiia po nukleinovym kislotam i nukleoproteidam. ***V. Tongur.*** *Voprosy Meditsinskoĭ Khimii,* v. 6, no. 2, Mar.-Apr. 1960, p. 215-219.

9900* The Mode of Reaction of Deoxyribonucleic Acid With Nitrous Acid. Contrary to the results found with ribonucleic acid from tobacco mosaic virus, in which all the aminobases are deaminated with about the same velocity, in native DNA the aminobases react with very different reaction velocities. In this case adenine and cytosine react much slower than does the guanine, also the ratios of velocities of the bases vary with the H-ion concentration of the solution. These results

confirm the existence of hydrogen bonds involving only the aminogroups of adenine and cytosine in native DNA. (*In German.*) Die Reaktionsweise der Desoxyribonucleinsäure mit salpetriger Säure. ***Heinz Schuster.*** *Zeitschrift für Naturforschung*, v. 15b, May 1960, p. 298-304.

9901* The Base Specificity in Induction of Mutations by Means of Nitrous Acid in Phage T2. In phage T2 treated with nitrous acid (HNO_2) the deamination rates of the aminobases G, A and HMC can be shifted relative to each other by altering the pH of treatment. Under various pH conditions the variation of the rates of HNO_2-induced r⁻ mutation and inactivation have been measured and compared to the corresponding alteration of the deamination rates. The deamination of the bases A and HMC can lead to mutagenic changes, whereas the deamination of G can only act lethally. (*In German.*) Die Basenspezifität bei der Induktion von Mutationen durch salpetrige Säure im Phagen T2. ***Walter Vielmetter and Heinz Schuster.*** *Zeitschrift für Naturforschung*, v. 15b, May 1960, p. 304-311.

9902* Photosensitized Degradation of Macromolecules With 3.4 Benzopyrene. The macromolecular substance tested was polymethacrylester (0.36 g/1), the solvent was benzene (20 mg/1). Radiation was carried out with a quartz mercury high pressure burner at room temperature. The degradation was viscosimetrically determined. The benzopyrene molecule modified by radiation served as the O_2 carrier. The sensitizer (3.4 benzopyrene) was not, or only partly, reconstructed. Extinction curves and loss of the characteristic fluorescence revealed that, with increasing radiation time, an irreversible change of the benzopyrene molecule must be assumed. (*In German.*) Über den mit 3.4-Benzypyren photosensibilisierten Abbau von Makromolekülen. ***H. Mönig and H. Kriegel.*** *Zeitschrift für Naturforschung*, v. 15b, May 1960, p. 333-334.

CERAMICS AND CONCRETE

9903* On the Relaxing Ability of Refractory Compounds. It is shown that internal stresses are relaxed in micro volumes at room temperature. Relaxative ability is determined by the class of the compound, its structure and by the force of the interatomic bond. (*In Ukrainian.*) Pro relaksatsiinu spromozhnist' tugoplavkykh spoluk. ***I. N. Frantzevich and A. N. Pilyankevich.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi*, 1960, no. 3, p. 339-341.

9904 Practical Grain Size Analysis of Clays. III. Log Probability Data Plotting. A suggestion for simplification of grain size analysis of clays in the 10.2-0.2 μ range by log probability plotting proved to be unworkable upon extension into coarser and finer regions. ***G. W. Phelps.*** *American Ceramic Society Bulletin*, v. 39, May 1960, p. 267-269.

9905 Thermal Properties of Six Glasses and Two Graphites. Thermal-conductivity, linear-thermal-expansion, specific-heat, and density values are reported for the following materials: white (clear) plate glass, Pyrex No. 774, Solex 2808X, Solex "S", Grades 7087 and GBH graphite, fused silica, and Vycor. The temperature range covered is, in general, from −250 to about 1000 F. ***C. F. Lucks, H. W. Deem, and W. D. Wood.*** *American Ceramic Society Bulletin*, v. 39, June 1960, p. 313-319.

9906 Factorial Design of Experiments in Ceramics. II. Illustrates the application of factorial design to the study of the unit operations of a semivitreous body formed by extrusion. It was found that the maximum modulus of rupture fell outside the limits of water of plasticity and the particle-size distribution as represented by the Ajax clays. ***George Dean and P. R. Jones.*** *American Ceramic Society, Journal*, v. 42, June 1960, p. 283-287.

9907 Processing of Positive Temperature Coefficient Thermistors. The controlled addition of impurities such as La in $BaTiO_3$ and Ba Sr TiO_3 systems results in thermistor materials which have large positive temperature coefficients of resistance over controlled temperature ranges. ***H. A. Sauer and J. R. Fisher.*** *American Ceramic Society, Journal*, v. 42, June 1960, p. 297-301.

9908 Nonuniform Toughening of a Glass Disk. It is possible to stipulate initial conditions and the manner of quenching in such a way that the intensity of toughening varies in the glass disk as a function of the radius without inducing a secondary radial stress system. ***P. G. Kalman.*** *American Ceramic Society, Journal*, v. 42, June 1960, p. 313-325.

9909* Carbon Dioxide in Hydrated Portland Cement. A study is made of the way in which carbon dioxide is held in carbonated samples of portland cement mortar and of calcium silicate hydrate using differential thermal, thermogravimetric, and X-ray diffraction methods. The results indicate that the carbon dioxide is chemically bound as calcium carbonate, largely in the form of poorly crystallized vaterite, aragonite, and calcite, and not as a silicate mineral. ***W. F. Cole and B. Kroone.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 12, June 1960, p. 1275-1295.

9910* The Relation Between Creep of Concrete and the Stress-Strength Ratio. The linear relation between creep and stress-strength ratio is verified for recent tests of various investigators. The relation between irreversible shrinkage and creep is discussed, and "corrected" graphs of time-deformation versus stress-strength ratio are presented. ***A. M. Neville.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods*, v. 9, no. 4, 1960, p. 285-292.

9911 Advancements in Technical Ceramics. The Use of Thermite Reactions to Produce Refractory Cermets. The method of fabricating refractory cermets from thermites is outlined. Tensile and transverse strength are presented for zirconium-disilicide bonded aluminum oxide. Methods for forming silicides, borides, and carbides are described, as are future high-temperature applications for such refractory cermets. ***Jesse D. Walton, Jr., Nick E. Poulos, and C. R. Mason.*** *Ceramic Age*, v. 75, no. 6, June 1960, p. 39-45.

9912 An Explanation for the Exothermal Reaction of Kaolinite as a "Reaction of the Active State". The metakaolinite is considered as a so-called "metaphase" i.e., as a non-densely packed series of dehydrated layer groups, which are in a condition of "labile equilibrium". In the temperature range 950-1000 C this "labile skelton" collapses and thereby causes the sharp exothermal effect. This process of structure collapse is a new type of reaction (reaction of the active state) which has not yet been investigated. For a substance to give such reactions which are typical of an active state it must be present in the so-called "metaphase". (*In German.*) Die Deutung der exothermen Reaktion des Kaolinits als "Reaktion des aktiven Zustandes". ***F. Freund.*** *Deutsche Keramischen Gesellschaft, Berichte*, v. 37, May 1960, p. 209-218.

9913 Liquid Immiscibility in Silicate Systems. Experimental data for silicate systems showing liquid immiscibility can be represented by a plot showing cation field strength versus the extent of the miscibility gap, provided a suitable "valence correction" is introduced. ***F. P. Glasser, I. Warshaw, and R. Roy.*** *Physics and Chemistry of Glasses*, v. 1, no. 2, Apr. 1960, p. 39-45.

9914 Kinetics of the Transport of Water Through Silicate Glasses at Ambient Temperatures. A solid foam, produced by flash-heating of water-containing rhyolitic glasses, hydrates progressively if exposed to air of high humidity. The water uptake follows initially a parabolic law and is accompanied by a volume expansion. ***Wolfgang Haller.*** *Physics and Chemistry of Glasses*, v. 1, no. 2, Apr. 1960, p. 46-51.

9915 The Application of Differential Thermal Analysis and Thermogravimetric Analysis to the Study of Reactions Between Glass-Making Materials. II. The Sodium Carbonate-Silica System With Minor Batch Additions. Addition of sodium fluoride, sodium silicofluoride, sodium chloride, or sodium nitrate to the mixture 85 mol. parts silica - 15 mol. parts sodium carbonate causes the chemical reactions to occur at lower temperatures. It has, however, no influence on the temperature of glass formation. ***C. V. Thomasson and F. W. Wilburn.*** *Physics and Chemistry of Glasses*, v. 1, no. 2, Apr. 1960, p. 52-69.

9916 The Hot Pressing of Fine Grained Ceramic Oxides for Use in Thermal Conductivity Studies. The relationships between time, temperature, pressure and grain growth in hot

pressing were studied using alumina grain to determine the techniques necessary for the production of dense polycrystalline alumina having a grain size in the four to five micron range. It was found that alumina could be produced using a short time at maximum temperature in hot pressing. ***R. K. Francis, J. J. Swica, R. S. Truesdale, and J. R. Tinklepaugh.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Note* 59-394, Feb. 1960, 26 pp. (TL507 Un3.18t Contin.)

9917 Mechanical Properties of Selected Alloys at Elevated Temperatures. II. Design Criteria of Silicon Carbide. A study was made of nondestructively testing SiC by density and density uniformity, dynamic modulus by sonic technique, X-ray diffraction under transverse load, electrical resistivity, and internal friction. Dynamic modulus of SiC was experimentally determined at 80 F and 2200 F. Modulus of rupture tests were conducted at 80 F, 2200 F and 2400 F. ***Harry A. Pearl, John M. Nowak, and Harry G. DeBan.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 59-702, pt. 2, Mar. 1960, 121 pp. (TL507 Un3.18w Vis.)

See also: **10512** (thermal stresses in brittle materials); **10534** (cathodic protection of prestressed concrete pipe); **10544** (tar-bonded dolomite-magnesia refractories).

CHEMICAL ENGINEERING

9918 Hydraulics of Pipe Outlets for Tile Drains. Basis for selection of correct size of outlet pipe for a tile drainage system. ***W. D. Lembke.*** *Agricultural Engineering*, v. 41, June 1960, p. 375-377.

9919* Guide to . . . Industrial Ventilation in the Chemical Industry. Ventilation problems peculiar to the chemical process industry and their solution. ***William V. Andresen.*** *Air Engineering*, v. 2, no. 6, June 1960, p. 34 + 1 page.

9920* Pure Oleic Acid From Olive Oil. Oleic acid of 99-100% purity has been prepared in 36-43% yield from olive oil. ***Leon J. Rubin and Willow Paisley.*** *American Oil Chemists' Society, Journal*, v. 37, June 1960, p. 300-302.

9921* Review of Desalinization Processes. The problem of water supply is receiving increasing attention—and with good reason. The United States now needs about 300 bgd of water. If population and water-use trends continue, then by 1980 the quantity of water needed will be 500-600 bgd and adequate water supply in the United States could become the nation's primary domestic problem in a relatively few years. One answer is to tap the practically inexhaustible supplies of the oceans and the large brackish water supplies of inland areas. The question is how to obtain fresh water from these sources at costs low enough for widespread use. The six papers presented at this panel discuss the following major groups: distillation with the use of fuels; solar-heat distillation; membrane processes; separation by freezing; and other chemical, electrical, or physical conversion methods. It is noted that no one process will ever be completely practical for all saline-water conversion. Different processes are advantageous for either of the two major divisions to be treated—sea water and brackish water. Naturally, other economic factors are to be considered. As with all such developments, the greatest and most limiting barrier is product cost. Despite recent inflation, however, the cost of desalinization has gone down and, in more advanced systems, the cost is less than $1.00/1000 gal. Use of waste heat from power plants or nuclear reactors could be effectively utilized. An interesting case history is presented for Coalinga, Calif., where the installation of an electrodialysis system reduced the cost of potable water by almost 80%. ***Joseph J. Strobel.*** *American Water Works Association, Journal*, v. 52, May 1960, p. 553-593.

9922* Polyethylene Glycol: A Material With Many Possibilities Due to the Modification of the Chemical Structure. A study of various compounds commercially known as "Carbowax", covering specific properties, adaptation to the metal industry, to the production of purification and polishing agents, to the preparation of plastic and adhesives, of pharmaceuticals and cosmetic articles, of antistatic products and lubricants in the textile industry, to uses in the paper and printing industry, electronics, and ceramic industry. (*In Dutch.*) Polyethyleenglycol: materiaal met velemogelijkheden door verandering van de chemische structuur. *Bedrijf en Techniek*, v. 15, May 14, 1960, p. 415 + 3 pages.

9923 Freezing the Salt Out of Water. Describes the Carrier and Blaw-Knox processes. *Business Week*, no. 1607, June 18, 1960, p. 111 + 2 pages.

9924 Continuous Monitoring of Uranium Leach Solutions. Determination by scintillation alpha-ray detection has been developed for possible application to the continuous monitoring and control of break-through in ion exchange columns. ***G. G. Eichholz.*** *Canada, Mines Branch, Research Report*, R-59, Jan. 21, 1960, 24 pp. (TN26 C16.5r Contin.)

9925* Salt Effect in Vapor-Liquid Equilibrium. II. Equilibrium data at atmospheric pressure are reported for the systems methanol-water, ethanol-water, and n-propanol-water, each saturated with a variety of common inorganic salts. ***A. I. Johnson and W. F. Furter.*** *Canadian Journal of Chemical Engineering*, v. 38, no. 3, June 1960, p. 78-87.

9926 Perchloroethylene. Market for use in dry cleaning and vapor degreasing is studied. ***Wallace U. Seiler.*** *Chemical and Engineering News*, v. 38, no. 22, May 30, 1960, p. 124 + 4 pages.

9927 Horizontal Flooded Bed Scrubs Gases. Uses flooded bed of aggregate, balanced countercurrent flow of gas and liquid to control air pollutants. *Chemical and Engineering News*, v. 38, no. 23, June 6, 1960, p. 57.

9928 Making Fresh Water From Salt Water. Government's final saline-conversion demonstration plant will use a freeze flowsheet. Two candidates are being considered. *Chemical Engineering*, v. 67, June 13, 1960, p. 152-155.

9929 New Air-Handling Concept Speeds Drying. Shrouded cylinders change drying mechanism in the dryer section of paper machines. *Chemical Engineering*, v. 67, June 13, 1960, p. 79 + 2 pages.

9930 A New Guide to Filter Media. ***Jules P. Kovacs.*** *Chemical Engineering*, v. 67, June 13, 1960, p. 209-212.

9931 Graphical Methods Aids Constant Rate Filtration Scaleup. Method obviates the difficulties ordinarily encountered. ***G. Edwin White and Seymour C. Hyman.*** *Chemical Engineering*, v. 67, June 13, 1960, p. 219-220.

9932 Chemicals From Methane. Analyzes shifts in source and end use of NH_3, C_2H_2, and derivatives, CH_3OH, chloromethanes, CS_2, and HCN. ***Richard F. Messing and James W. Bradley.*** *Chemical Engineering*, v. 67, June 27, 1960, p. 74 + 3 pages.

9933 Polypropylene by the Ziegler Process. Improved catalyst system and streamlined flowsheet characterize Humble's version of the Ziegler process now operating. *Chemical Engineering*, v. 67, June 27, 1960, p. 96-99.

9934 Find Effective Length of U-Tubes. Use of correction chart in design. ***D. L. Whitley and E. E. Ludwig.*** *Chemical Engineering*, v. 67, June 27, 1960, p. 111-112.

9935 Estimate Manufacturing Costs. Determines which way is cheapest from R & D data. ***Richard M. Berry.*** *Chemical Engineering*, v. 67, June 27, 1960, p. 123 + 2 pages.

9936* Oxygen Plant Reboiler Explosion. Laboratory study of plant clues indicate a co-crystal of acetylene and nitrous oxide, which built up over a six-month period at the bottom of the reboiler, caused plant mishap. ***R. W. Rotzler, J. A. Glass, W. E. Gordon, and W. R. Heslop.*** *Chemical Engineering Progress*, v. 56, June 1960, p. 68-73.

9937 CPI's Water Needs Rise. Predicts that chemical process industries water consumption will be tripled by 1980. *Chemical Week*, v. 86, no. 26, June 25, 1960, p. 67-68.

9938* The Influence of Voids Volume on the Pressure Loss in Packed Columns Through Which a Gas Flows. (*In German.*) Einfluss des Lückenvolumens auf den Druckverlust in gasdurchströmoten Füllkörpersäulen. ***G. Sonntag.*** *Chemie-Ingenieur-Technik*, v. 32, May 1960, p. 317-329.

9939* Simplified Method for Measurement of Surface Areas by Gas Adsorption. Measurement has been developed on the basis of the BET method. Requires no vacuum technique and by the use of a differential arrangement permits measurement of relatively small surface areas, for example, pigments. (*In German.*) Vereinfachte Methode zur Messung von Oberflächengrössen durch Gasadsorption. ***R. Haul.*** *Chemie-Ingenieur-Technik*, v. 32, May 1960, p. 349-354.

9940 The Production of Bulk Organic Chemicals. The history of the production, present production pattern, switch over to petroleum, provision of chemical feedstock, composition of crude oil, choice of feedstock, refinery and natural gas, and economics are discussed. ***D. G. Smith.*** *Chemistry & Industry*, 1960, no. 19, May 7, p. 508-515.

9941* Trends in Petroleum Refining. A review. ***D. W. Emmerson.*** *Chemistry in Canada*, v. 12, May 1960, p. 25-32.

9942* Advance Spray-Drying Techniques. Solves problem of drying hygroscopic, heat-sensitive products. ***Howard P. Milleville.*** *Food Processing*, v. 21, June 1960, p. 32-33.

9943 Application of Heat Exchangers in Chemical Plants. Because of the large investment and number of problems the heat exchanger represents, engineers should pay more attention to its design, specification, and performance in chemical plants. Various types are described. ***C. H. Gilmour.*** *Industrial and Engineering Chemistry*, v. 52, June 1960, p. 465-467.

9944 Continuous Process Control. Apparatus for analysis for water in liquid hydrocarbons, for in-process chromatographic analysis, and a photoelectric analyzer are described. ***D. D. Friel.*** *Industrial and Engineering Chemistry*, v. 52, June 1960, p. 494-496.

9945 Chemical Process Improvement by Response Surface Methods. A Case History. Response surface experimentation is an efficient method of doing chemical research without the inadequacies of other empirical techniques, and can lead to a better definition of the experimental variables of the system. ***Paul W. Tidwell.*** *Industrial and Engineering Chemistry*, v. 52, June 1960, p. 510-512.

9946 Mixing of Solids With Horizontal Drum-Type Mixers. Mixers were made from sections of standard tubing or pipe which were machined to give a round drum with minimum roughness at the junction. ***John B. Gayle and James H. Gary.*** *Industrial and Engineering Chemistry*, v. 52, June 1960, p. 519-520.

9947 Processing Industrial Gas Streams at High Pressures . . . Diffusion of Hydrogen Through Palladium Membranes. Permeability of Pd to H suggests interesting techniques for large-scale separation of process gas streams. ***A. J. deRosset.*** *Industrial and Engineering Chemistry*, v. 52, June 1960, p. 525-528.

9948 Mixing. A large amount of experimental work covering the entire field of fluid and solids mixing, with mechanics of two-phase mixing operations receiving considerable attention. ***J. Henry Rushton.*** *Industrial and Engineering Chemistry*, v. 52, June 1960, p. 543-544.

9949 The Development of an Efficient Fractionating Condenser. Construction of a novel type of fractionation packing specially suited to be incorporated within a brazed plate-type heat exchanger is described. This packing was first tested as a normal adiabatic fractionator and was then installed in a partial condenser and tested with acetone/benzene and methanol/ethanol mixtures. ***G. G. Haselden, W. A. Platt, and A. Wahhab.*** *Institution of Chemical Engineers, Transactions*, v. 38, no. 2, 1960, p. 46-53.

9950 Development of the Fulham—Simon-Carves Flue Gas Washing Process. Surveys processes for the removal and reclamation of S from the waste gases of power stations, possibly with profit. ***C. W. Wood.*** *Institution of Chemical Engineers, Transactions*, v. 38, no. 2, 1960, p. 54-62.

9951 A Theoretical Method for Predicting Heat Transfer Distribution in a Petroleum Heater. ***W. T. Thorneycroft and M. W. Thring.*** *Institution of Chemical Engineers, Transactions*, v. 38, no. 2, 1960, p. 63-70.

9952* Low Temperature Catalytic Cracking of Solid Hydrocarbons. This type of cracking obtained after deparaffination of oils, can be used to accumulate in the cracking material solid hydrocarbons with a lower melting temperature. Paraffin containing oil which cannot be pressed out, obtained on the equipment of distilled oil deparaffination, and petroleum obtained after deparaffination of the residual oils can be used as raw materials for the process. (*In Russian.*) Nizkotemperaturnyĭ kataliticheskiĭ kreking tverdykh uglevodorodov. ***N. I. Chernozhukov and L. M. Rogacheva.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Neft' i Gaz*, v. 3, no. 2, 1960, p. 99-106.

9953 Preparation of Aluminium Soaps by a Continuous Process. III. Aluminium 2-Ethylhexoate. IV. Aluminium Soaps of Mixtures of Straight and Branched Chain Synthetic Aliphatic Acids. ***D. E. Woods and A. J. Taylor.*** *Journal of Applied Chemistry*, v. 10, pt. 5, May 1960, p. 197-203.

9954* Effluent Treatment at a Fine Chemicals Factory. Describes a plant now in operation on effluent which must be discharged to the sea in a harbor which is much used for yachting and fishing. ***D. H. Bell.*** *Manufacturing Chemist*, v. 31, May 1960, p. 194-197.

9955* Treatment of Effluents From the Manufacture of Weedkillers and Pesticides. The effluent plant is novel in that it employs active C to deal with bactericidal or bacteriostatic organic compounds. ***A. E. Lambden and D. H. Sharp.*** *Manufacturing Chemist*, v. 31, May 1960, p. 198-201.

9956 Latest Advances in Selective Adsorption. Some crystalline zeolites act as molecular sieves by adsorbing or rejecting molecules on the basis of their molecular size. Shows how adsorbents can be used for octane improvement. ***G. J. Griesmer, H. B. Rhodes, and K. Kiyonaga.*** *Petroleum Refiner*, v. 39, June 1960, p. 125-132.

9957 Latest Advances in Membrane Permeation. Shows how close this unit operation is to commercialization. Described as a fast-breaking process. ***Burton H. Sanders and Chai Y. Choo.*** *Petroleum Refiner*, v. 39, June 1960, p. 133-138.

9958 Latest Advances in Superfractionation. Designed for cases where the relative volatility varies from top to bottom trays. ***Francis W. Winn.*** *Petroleum Refiner*, v. 39, June 1960, p. 139-145.

9959 Latest Advances in Extractive Distillation. Reviews recent developments concerning the choice of proper separating agent. ***J. A. Gerster.*** *Petroleum Refiner*, v. 39, June 1960, p. 146-148.

9960 Latest Advances in Liquid Extraction. A forecast for the future. ***M. R. Fenske, W. G. Braun, and D. Quiggle.*** *Petroleum Refiner*, v. 39, June 1960, p. 149-155.

9961 Latest Advances in Thermal Diffusion. The trend is toward more equipment studies rather than specific product studies. Reviews applications in the refining and petrochemical industry. ***Glenn R. Brown and A. Letcher Jones.*** *Petroleum Refiner*, v. 39, June 1960, p. 156-162.

9962 When Metals Poison Cracking Catalyst. Effects of poisons on fluid catalytic cracking yields and how the H producing factor can be used as a criterion for operating a commercial unit. ***Earl C. Gossett.*** *Petroleum Refiner*, v. 39, June 1960, p. 177-180.

9963 Absorber Design—Fast Yet Rigorous. A graphical modification to the Kremser absorption calculation can be made in two to three hours. ***Spencer H. Landes and F. W. Bell.*** *Petroleum Refiner*, v. 39, June 1960, p. 201-206.

9964* Piping. Covers materials, supports, expansion joints, fittings, fluid losses, and ASA standards. ***T. W. Edwards.*** *Power*, v. 104, June 1960, p. 51-66.

9965 Saline Water Conversion. Report for 1959. Report of the activities of the Office of Saline Water contains information on developments. 108 pp. Jan. 1960. U. S. Department of the Interior, Washington, D. C. (QH88 Un3.4a)

9966* Heat Transfer During Condensation of Saturated Steam on the Surface of a Bundle of Vertical Pipes. Results of tests conducted on an experimental boiler are presented. (*In*

Russian.) Teplootdacha pri kondensatsii nasyshchennogo para na poverkhnosti puchka vertikal'nykh trub. ***B. I. Levin.*** *Teploenergetika*, v. 7, no. 5, May 1960, p. 73-75.

9967* An Investigation Into Contact Heat Exchange. Theoretical calculation to determine the value of thermal resistance between two rough surfaces at different compression stresses and machining of the surfaces. (*In Russian.*) Issledovanie kontaknogo teploobmena. ***Iu. P. Shlykov, E. A. Ganin, and N. B. Demkin.*** *Teploenergetika*, v. 7, no. 6, June 1960, p. 72-76.

9968 Development of Agent Flow Measurement Methods. Pertains to the agent in fire-extinguishing systems. ***Ralph L. Hough and William R. Kane.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Note* 59-183, Mar. 1960, 40 pp. (TL507 Un3.18T Vis.)

9969* Thickening of Raw Sludge. Pilot-plant experiments in thickening before pumping to the digesters have indicated optimum suspended solids loading and sludge blanket thickness for obtaining high solids concentration. ***C. E. Keefer.*** *Water & Sewage Works*, v. 107, June 1960, p. 218-222.

9970* Petrochemical Carbon Disulfide From Methane. Recent additions to petrochemical CS_2 capacity. ***Peter W. Sherwood.*** *World Petroleum*, v. 31, June 1960, p. 62 + 3 pages.

See also: **10346** (fluid flow); **10526** (corrosion inhibitor for aerosol products); **10531** (corrosion control in petroleum refineries).

CHEMISTRY—ANALYTICAL

9971* New Rapid Gravimetric Method of Quantitative Determination of Ferrous Iron. Fe^{+2} was determined as ferrous nitromalonylurea by direct suspension of the ferrous diliturate $(C_4H_2O_5N_3)_2Fe \cdot 8H_2O$. A new formulation of the metal diliturates as internal complex salts in the form of spiro compounds was indicated. (*In Rumanian.*) O noua metoda rapida pentru dozarea fierului feros pe cale gravimetrica. ***J. Dick and C. Drugarin.*** *Academia Republicii Populare Romine. Baza de Cercetări Ştiinţifice, Timişoara. Studii Şi Cercetări Ştiinţifice. Seria Ştiinţe Chimice*, v. 5, nos. 3-4, July-Dec. 1958, p. 39-43.

9972* A New Rapid Method for the Rapid Quantitative Determination of Zinc. The method is based on the precipitation of Zn^{+2} by means of an aqueous solution of picrolonic acid in the form of $Zn(C_{10}N_4O_5H_7)_2 \cdot 2H_2O$. The precipitate after direct washing on the filter with alcohol and ether is weighted as such. The method is sufficiently accurate. (*In Rumanian.*) O nouă metodă rapidă pentru dozarea gravimetrică a zincului. ***D. Becherescu.*** *Academia Republicii Populare Romine. Baza de Cercetări Ştiinţifice Timişoara. Studii Şi Cercetări, Ştiinţifice. Seria Ştiinţe Chimice*, v. 6, nos. 1-2, Jan.-June 1959, p. 123-126.

9973* A Critical Study of the Oxidation Methods for the Determination of Glyceride Composition of Fats. A critical evaluation of the individual steps in Hilditch's acetone-permanganate and Kartha's acetone-acetic acid-permanganate oxidation methods for the determination of the glyceride type of composition of fats was carried out in order to examine the limitations of these methods. ***Gollamudi Lakshminarayana and Damascene Rebello.*** *American Oil Chemists' Society, Journal*, v. 37, June 1960, p. 274-281.

9974* The Determination of Chemical Antioxidants in Fats After Separation by Partition Chromatography. Reverse-phase partition chromatography is used to separate butylated hydroxyanisole and the gallate esters from fat. The gallate esters are determined colorimetrically after reaction with ferrous tartrate, and butylated hydroxyanisole after reaction with 2:6-dichloroquinone chloroimide. A method is described for determining butylated hydroxytoluene in ethanolic solution; it depends on measuring the ultraviolet absorption spectra of strongly alkaline solutions of butylated hydroxytoluene. ***K. G. Berger, N. D. Sylvester, and D. M. Haines.*** *Analyst*, v. 85, May 1960, p. 341-346.

9975 Separation and Microdetermination of Hexahydro-1,3,5-trinitro-s-triazine in Octohydro-1,3,5,7-tetranitro-s-tetrazine. Partition chromatographic systems found which are applicable to high-explosive mixtures. One of these systems has been adapted to the separation of RDX and HMX. RDX is eluted from the paper and determined as formaldehyde by the chromotropic acid procedure. ***S. K. Yasuda and R. N. Rogers.*** *Analytical Chemistry*, v. 32, July 1960, p. 910-911.

9976 Quantitative Radiochemical Analysis by Ion Exchange—Uranium and Tellurium. Tellurium radionuclides from fission product mixtures are eluted with U from Dowex 2 anion resin in the quantitative radiochemical procedure previously reported. The separation of these two elements from each other is necessary for their determination. The adsorption of Te(IV) from phosphoric acid solutions was investigated. From similar data on U(VI), a procedure for the separation of Te from U was obtained. Column runs indicated that the yields were quantitative and the purities greater than 99%. The procedure was then expanded to permit inclusion in the sequential radiochemical analytical scheme for mixed fission product and actinide elements. ***Leon Wish.*** *Analytical Chemistry*, v. 32, July 1960, p. 920-922.

9977 Spectrographic Analysis of High Purity Silicon Carbide. Direct spectrographic method for the determination of trace impurities in semiconductor grade silicon carbide with limits of sensitivities for many elements in the range 10 to 300 p.p.b. ***George H. Morrison, Richard L. Rupp, and George L. Kiecak.*** *Analytical Chemistry*, v. 32, July 1960, p. 933-935.

9978 Determination of Hydrogen in Steel. Comparison of Tin-Fusion and Hot-Extraction Techniques. Tests on specimens obtained from a molten bath and from large rotor forgings of low-alloy steels show that the same H content is obtained by the tin-fusion technique at 1150 C and by the hot-extraction technique at either 975 or 650 C. The precision of the hot-extraction technique was found to be much better. The hot-extraction technique is preferable not only because of its better precision but also from the point of view of simplicity of apparatus and convenience of operation. ***Chester C. Carson.*** *Analytical Chemistry*, v. 32, July 1960, p. 936-939.

9979 Spectrophotometric Determination of Olefins in Concentrated Sulfuric Acid. New spectrophotometric method for the determination of small quantities of olefins is based on the absorbance produced in the 300- to 310 mμ range from their reaction with concentrated sulfuric acid. ***A. P. Altshuller, S. F. Sleva, and A. F. Wartburg.*** *Analytical Chemistry*, v. 32, July 1960, p. 946-954.

9980 The Sulfur Dioxide Test for Selenious Acid. Although the sulfur dioxide test for selenious acid has long been used, the conditions for optimum sensitivity have not been critically studied, nor has proper attention been given to the possibility of interference from selenic acid. Both hydrogen ion concentration and temperature affect its sensitivity. The optimum sulfuric acid concentration is about 5.5M and the optimum temperature is 80 to 90 C. This test is unreliable for distinguishing selenious acid from selenic acid, and especially for the detection of small proportions of selenious acid in selenic acid. Hydrogen peroxide inhibits the test. It should no longer be used to detect the completeness of oxidation of selenious acid in the preparation of selenic acid by hydrogen peroxide oxidation. ***Earle R. Caley and Clayton L. Henderson.*** *Analytical Chemistry*, v. 32, July 1960, p. 975-978.

9981 Fluorometric Determination of Traces of Selenium. Fluorometric method using 3,3'-diaminobenzidine has been developed for determining as little as 0.02 μg of Se in plant and other materials. ***J. H. Watkinson.*** *Analytical Chemistry*, v. 32, July 1960, p. 981-983.

9982* Concerning New α,α' Disubstituted Azo Alkanes. A number of aliphatic α,α'-dichloro-azo alkanes is described. The Cl atoms of these compounds are easily exchanged against nucleophilic groups. α,α'-Diacetoxy-azo alkanes result with sodium acetate in glacial acetic acid. With alkali salts of thio acids, thiols, etc., derivatives of α,α'-dimercapto-azo alkanes are formed, and with sodium cyanide, the well known azonitriles are obtained. UV spectra have a maximum around 360 mμ. (*In German.*) Über neue α,α'-disubstituierte Azoalkane. ***Erhard Benzing.*** *Annalen der Chemie (Justus Liebigs)*, v. 631, nos. 1-3, 1960, p. 1-9.

9983 Electron Probe Methods of X-Ray Microanalysis. The use of an electron probe to produce a point source of X-rays permits chemical analysis, the X-ray absorption or fluorescence spectroscopy, of regions down to 1 to 10μ in diameter. For the study of surfaces, the emission method, in which the probe excites the specimen itself, is more suitable; this gives a resolving power of about 1μ and a detection sensitivity of 10^{-14} g. The three methods of X-ray microanalysis which are described—absorption, fluorescence and emission—are essentially complementary. The absorption method is suited to the accurate determination of a known element distributed throughout the thickness of a section of biological or mineral material, whereas, by the fluorescence method, unknown elements in such specimens can be rapidly identified with poorer resolution but high concentration sensitivity. The emission method can be used only for the study of surfaces, but gives a resolution of 1μ and permits rapid qualitative and quantitative analysis. Apparatus, at least for emission analysis, is becoming available, and it is likely that the use and extension of these electron probe methods of microanalysis will add materially to knowledge of the microstructure of many classes of material. ***P. Duncumb.*** *British Journal of Applied Physics*, v. 11, May 1960, p. 169-176.

9984* New N.B.S. Coulometric Method Can Determine One Part in 100,000. The scientists of the U. S. National Bureau of Standards have improved the constant-current method by designating a modified titration cell and a procedure for its use. The cell consists of two compartments—one containing a Pt cathode and the other a Ag anode—separated by fritted glass discs. An alkali chloride solution is used as the electrolyte. *Chemical Age*, v. 83, May 14, 1960, p. 812.

9985* Analytical Possibilities of the Schumann Spectral Region. The main operating difficulties met in the spectral region below 2000 Å (Schumann region) are reviewed. The difficulties are due to the absorption of radiations by residual gases and by optical materials of the spectrograph, to the light sources, which must be specially designed, and to the detectors and radiation meters. This region looks promising for analytical purposes, mainly for the elements which do not give spectral lines in other regions. (*In Italian.*) La regione di Schumann e le sue possibilità analitiche. ***Giulio Milazzo.*** *Chimica e l'Industria*, v. 42, May 1960, p. 484-486.

9986* Automatic Rapid Analysis by X-Ray Fluorescence of the Mineral Powders and of Solutions From Hydrometallurgical Plants From the High Katanga Mining Union. Rapid and accurate determination of the amount of Cu, Zn and Co in the Cu-Zn and Cu-Co-containing ores and in their concentrates is possible by X-ray fluorescence. The three elements were analyzed, starting from three determination curves covering the following ranges of concentration: Zn: 0.05-60%, Cu: 0.05-50%, Co: 0.05-5%. (*In French.*) Analyse rapide automatique par fluorescence des rayons X des poudres minérales et des solutions d'usines hydrométallurgiques de l'Union Minière du Haut-Katanga. ***A. Hans.*** *Chimie Analytique*, v. 42, May 1960, p. 236-244.

9987* Elemental Analysis of Alnico-Type Alloys by X-Ray Fluorescence. Cobalt does not interfere even in the determination of Cu. It is impossible to analyze Al in the same way as Fe, Co, Ni and Cu because the fluorescent rays of this element have relatively large wavelengths and are thus absorbed by the air; the analysis of Al must therefore be performed in vacuum with the help of a special counter. ***P. Blavier, A. Hans, P. Tyou, and I. Houbart.*** *Cobalt*, no. 7, June 1960, p. 33-37.

9988* Determination of Diazophenols by Reduction by Means of Bivalent Vanadium Salts. A method was developed for the quantitative determination of diazophenols (quinone diazides) by the reduction of their acid solutions by bivalent V salts with subsequent titration of its excess by means of a solution of ammonium ferric alums. Reduction is accompanied by a quantitative formation of N with the replacement of the diazo group by H. For the reduction of one gram-mole of diazophenol, two equivalents of the reducing agent are used. (*In Russian.*) Opredelenie diazofenolov vosstanovleniem soliami dvukhvalentnogo vanadiia. ***A. A. Nemodruk and V. F. Oreshko.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Khimiia i Khimicheskaia Tekhnologiia*, v. 3, no. 2, 1960, p. 316-319.

9989* Sensitivity of the Fluorescence Test for Amino Acids. The purpose of the present investigations was: to determine the sensitivity of the ordinary and sensitized u.v. tests for more than 20 amino acids; to study the influence of the temperature and heating time on the intensity of the fluorescence; to compare the sensitivity of the test before and after the development of the chromatogram in the systems phenol-water and propanol-water; to adapt the u.v. test, as has been done with the ninhydrin test, to the detection of amino acids in biological fluids. ***J. Opieńska-Blauth, M. Sanecka, and M. Chareziński.*** *Journal of Chromatography*, v. 3, no. 5, May 1960, p. 415-424.

9990* Chromatographic Determination of Cysteic Acid. A preparative column is described, which gave a resolution equal to that of an analytical column run under the same conditions. ***Selma L. Bandemer and Robert John Evans.*** *Journal of Chromatography*, v. 3, no. 5, May 1960, p. 431-437.

9991* Continuous Electrophoretic Separations of Radioactive Rare Earth Mixtures. I. Separation of ^{141}Ce-^{160}Tb-^{170}Tm and ^{144}Ce-^{152}Eu-^{169}Yb in 0.05*M* Lactic Acid. Below each radioautograph of the continuous separation, the activities of the separated rare earths are presented in a diagram. From the diagrams of activities and from the radioautographs, it is evident that the separation of both rare earth mixtures into components was complete. The usefulness of the continuous electrophoretic separations of radionuclides for preparative carrier-free separations and radiometric qualitative and quantitative analyses is discussed. ***Z. Pučar and Z. Jakovac.*** *Journal of Chromatography*, v. 3, no. 5, May 1960, p. 477-481.

9992* A Chemichromatographic Micromethod of Determining Phosphorus. Quantitative determination of microgram quantities of mineral phosphorus by means of impregnation. ***R. Antoszewski and J. S. Knypl.*** *Mikrochimica Acta*, 1960, no. 3, p. 325-331.

9993* Microdetermination of Alkoxyl Groups by a New Combustion Method. Alkyl iodide formed by hydrolysis of the sample with hydriodic acid is distilled into a combustion tube and burned with a Pt contact in an air stream. Iodine and carbon dioxide are formed quantitatively. From the weight of the I, the content of alkoxyl is calculated. From the molecular ratio between the carbon dioxide and the I found, the alkoxyl groups are characterized. ***Minoru Fukuda.*** *Mikrochimica Acta*, 1960, no. 3, p. 448-459.

9994* Spectrophotometric Method to Determine Zirconium in Amygdalic Acid. Low amounts of Zr (0.05 mg) were detected by this method in the pure salt solution. The condition to determine Zr in the presence of Th (1:5) and Ti (1:10) were defined. A study of the composition of an ammonium solution of Zr mindalate revealed the following composition: $(NH_4)_4\ Zr(C_6H_6O_5)_4$. (*In Russian.*) Spektrofometricheskiĭ metod opredeleniia tsirkoniia mindal'noĭ kislotoĭ. ***V. M. Peshkova, N. V. Mel'chakova, and A. B. Urazbekova.*** *Moscow. Universitet, Vestnik, Seriia Matematiki, Mekhaniki, Astronomii, Fiziki, Khimii*, 1959, no. 6, p. 150-155.

9995* The Use of Butyl Triethyl Ammonium Hydroxide as an Agent of Titration in the Potentiometric Determination of Weak Acids in Non-Aqueous Solvents. A polyester and adipic acid in various solvents are chosen as an example for weak acids. N/10 concentrations did not reveal a superiority of butyl triethyl ammonium hydroxide, while the relatively rapid dissociation of the quaternary base into tertiary amine is a disadvantage in comparison with the considerable stability of sodium ethylate in n/100 concentrations. (*In German.*) Butyltriäthylammoniumhydroxyd als Titrationsmittel zur potentiometrischen Bestimmung schwacher Säuren in nichtwässrigen Lösungsmitteln. ***P. Fijolka and I. Lenz.*** *Plaste und Kautschuk*, v. 7, Apr. 1960, p. 169-170.

9996 Proceedings of the International Symposium on Microchemistry. Contains papers covering qualitative microanalysis, decomposition of organic matter, weighing, element and group determination, physical constant determination, biochemical methods, chromatography and ion exchange, polarography, radiochemical methods, spectrochemical methods, titrimetry, complexometry, industrial applications of microchemistry, teaching trends, and apparatus used. 583 pp. 1960. Pergamon Press Ltd., New York. (QH221 In2p)

9997* Paper Chromatography of 2,4-Dinitrophenylhydrazones of Aromatic Ketones. Separation of 2,4-dinitrophenylhydrazones of alkyl aryl, cycloalkyl aryl ketones and

diaryl ketones effected on Whatman paper by using water-N, N-dimethylformamide as the stationary phase, and cyclohexane-carbon tetrachloride-N, N-dimethylformamide (20:4:1) as the mobile phase. The *Rf* values of eight ketones and those of three typical aldehydes are given for comparison. ***Eli Breuer, Haim Leader, and Shalom Sarel.*** *Research Council of Israel, Bulletin*, v. 9A, nos. 1-2, Apr. 1960, p. 43-45.

9998 Investigation of Spectrochemical Solution-Methods of Analysis. The Use of Designed Experiments and Statistical Methods of Analysis in the Interpretation of Data. Forty-six systems for introducing a liquid sample into the spark-gap of a spectrograph were studied by means of eight designed experiments. ***J. A. Norris and Roberta L. McCutchen.*** *U. S. Atomic Energy Commission, ORNL-2927*, May 9, 1960, 37 pp. (UF767 U3o Contin.)

9999* Study of the Accuracy of a Spectrographic Method of Open-Hearth Slag Analysis. An important part of the total reproducibility error in spectral analysis of open-hearth slags from the solution is due to uncontrollable conditions of reduction of the slag into solution. Precision of analysis of slag is decreased by a change in the acidity of solution. This must be kept constant. The accuracy of analysis is increased if the working conditions of the generator in a complex system are L = 0.15 mgn. (*In Russian.*) Izuchenie tochnosti spektrograficheskogo metoda analiza martenovskikh shlakov. ***K. I. Ionova.*** *Zavodskaia Laboratoriia*, v. 25, no. 5, 1960, p. 581-587.

10000* Mercury(I)-Titrations With Variamine Blue as Redoxindicator. Determination of Chloride-, Bromide- and Mercury(I)-Ions. 4-Amino-4'-methoxy-diphenylamine is used as indicator, turning violet in the case of oxidation with Mercury(I) ions, and active in the pH range 2 - 6. The results of titration are reproducible and agree with the results of other titration methods. (*In German.*) Quecksilber(I)-Titrationen mit Variaminblau als Redoxindicator. Bestimmung von Chlorid-, Bromid- und Quecksilber(I)-ionen. ***Zbigniew Gregorowicz and Jerzy Stoch.*** *Zeitschrift für Analytische Chemie*, v. 173, no. 5, 1960, p. 383-388.

10001* Concerning the Quantitative Analysis Determination of Molybdenum. Reduction of the Molybdate Ion in the Silver Reducing Agent. It is possible to determine the molybdate ion after reduction in the silver reducing agent (75 C, 2 *N* HCl) within a concentration range of 1-5 mg Mo, by titration with a 0.01 *N* Ce $(SO_4)_2$-solution, and within a range of 5-250 mg Mo with a 0.1 *N* $Ce(SO_4)_2$ solution, with ferroine as the indicator with a relative error of ± 0.2%, if the hydrochloric acid concentration is brought to 4 *N* after reduction. (*In German.*) Über die massanalytische Bestimmung des Molybdäns. Reduktion des Molybdations im Silberreduktor. ***H. Grubitsch, K. Halvorsen, and G. Schindler.*** *Zeitschrift für Analytische Chemie*, v. 173, no. 5, 1960, p. 414-420.

10002* Emission Increase in the Aluminum Flame Spectrum Due to Fluoride Ions. A hydrofluoric acid addition produces a specific increase of the Al emission, which is further raised by the replacement of the solutions by n-Butanol. The limit of detectability for Al is about 1 mg Al_2O_3/100 ml by measuring the effective band height at 484 nm. The increase of the emission makes it possible to determine Al directly even in the case of low Al_2O_3 contents, besides a series of other elements. (*In German.*) Die Emissionserhöhung des Aluminium-Flammenspektrums durch Fluoridionen. ***K. Konopicky and W. Schmidt.*** *Zeitschrift für Analytische Chemie*, v. 174, no. 4, 1960, p. 262-268.

10003* Analyses by Use of the Omegatron of Residual Gases by Evaporation Over Deposited Metal-Films in Ultra High Vacuum. The omegatron, a mass-spectrometer based on the cyclotron principle, qualifies for analysis of gases. The construction and the operating of the omegatron is briefly described. Residual gas mixtures were analyzed by evaporation over deposited iron-nickel- and platinum films at temperatures of 20, 100 and 200 C. (*In German.*) Analyse der Restgase über im Ultrahochvakuum aufgedampften Metallfilmen mit Hilfe des Omegatrons. ***H. Gentsch.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 24, nos. 1-2, Apr. 1960, p. 55-65.

10004* Synthesis of Racemic N-Acetylhomomeroquinene. The application of a xanthogenic method for the dehydration of ethyl ether 3-(β-oxyethyl)-4-(β-carboethoxyethyl) N-acetylpiperidine with formation of the ethyl ether of the racemic compound studied, was described. (*In Russian.*) Sintez ratsemicheskogo n-atsetilgomomerokhinena. ***M. V. Rubtsov.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 5, May 1960, p. 1498-1507.

10005* Ethers of Arylsulfonimidophenylphosphinous Acids. The dimethyl, diethyl and diphenyl ethers of these acids were synthesized and subjected to hydrolysis. A series of monoalkyl and monophenyl ethers were obtained. (*In Russian.*) Efiry arilsul'fonimidofenilfosfinovykh kislot. ***V. I. Shevchenko and V. T. Stratienko.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 5, May 1960, p. 1561-1565.

10006* Synthesis of 5 Bromoquinoline. A method was developed to obtain 5-bromoquinoline, starting from 8-aminoquinoline; by bromination acetyl derivative is converted into 5 bromo-8-acetylaminoquinoline, which after separation of the acetyl group and elimination of the amino group by means of a diazo compound, is converted into 5-bromoquinoline. (*In Russian.*) Sintez 5-bromkhinolina. ***Iu. A. Bankovskiĭ, L. A. Fedotova, and D. E. Zaruma.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 5, May 1960, p. 1614-1616.

10007* Complex Compounds of Tin and Titanium Halides With Organic Substances Containing CO= and -COC- Groups. The reaction of $SnCl_4$, $SnBr_4$ and $TiCl_4$ with quinone furfurole, dioxane and diethyl-oxalate was studied. The following complex compounds were obtained: $(SnCl_4 \cdot C_5H_4O_2)_{21}$, $SnCl_4 \cdot (COOC_2H_5)_2$, $SnBr_4 \cdot 2C_5H_4O_2$, $TiCl_4 \cdot 2C_5H_4O_2$, $SnCl_4 \cdot C_4H_8O_2$, $SnBr_4 \cdot C_4H_8O_2$ and $TiCl_4 \cdot 2C_4H_8O_2$. The complex compounds of stannic chloride with quinone and diethyl oxalate of equimolar composition are dimers, that is, correspond to the general formula $(MeX_4.A)_2$. (*In Russian.*) Kompleksnye soedineniia galogenidov olova i titana s organicheskimi veshchestvami, soderzhashchimi CO= i -COC-gruppy. ***T. Sumarokova, In. Pevskaia, and E. Iarmukhamedova.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 5, May 1960, p. 1705-1714.

See also: **10058** (paper chromatography of organic acids); **10240** (analysis of zinc-plating baths); **10242** (analysis of Cr plating baths).

CHEMISTRY—INORGANIC AND GENERAL

10008* Precipitation of Uranyl Salts by Means of Aromatic Amines. The reaction in an aqueous solution between uranyl nitrate and uranyl iodide and some organic amines with basicity constants of the order of 10^{-4} (pyridine, quinoline, aniline and p-toluidine) was studied. These are equilibrium reactions. An excess of the base is necessary for the quantitative precipitation of uranyl. The resulting product is represented by the formula $UO_3 \cdot 2H_2O$. (*In Rumanian.*) Precipitarea sarurilor de uranil cu amine aromatice. ***C. Drăgulescu and I. Julean.*** *Academia Republicii Populare Romine. Baza de Cercetări Ştiinţifice Timişoara. Studii Si Cercetări Ştiinţifice. Seria Ştiinţe Chimice*, v. 6, nos. 1-2, Jan.-June 1959, p. 51-57.

10009 The Preparation and Crystal Structure of Molybdenum(III) Fluoride. MoF_3 has been prepared by the reduction of MoF_5 with Mo metal powder. X-ray and neutron diffraction showed the crystal structure of this compound to be of the rhombohedral VF_3-type, rather than the cubic ReO_3-type structure previously reported. ***D. E. LaValle, R. M. Steele, M. K. Wilkinson, and H. L. Yakel, Jr.*** *American Chemical Society, Journal*, v. 82, May 20, 1960, p. 2433-2434.

10010* Constitution and Solubility of Vitreous Phosphates and Slags. Diffraction angle of center of X-ray halo of glasses is principally determined by a ratio of the number of cations coordinated by six (or eight) oxygen ions to that coordinated by for oxygen ions. ***Jumpei Ando.*** *Chemical Society of Japan, Bulletin*, v. 33, no. 5, May 1960, p. 685-692.

10011* On the Ability of Coarse Grained Aluminium Hydroxide to Induce Nucleation in Decomposition of Aluminate Solutions. Experiments are reported by which the presence of new fine crystallites was established after seeding aluminate solutions with coarse grained hydrargillite. The pres-

ence of the newly formed fines is attributed to chipping off the dendrites formed on the surface of large crystals as shown by electron micrographs. The intermediate range of particle sizes is due to fracture of large crystal growing. These are cases when some time is needed for the coarse particles to become able to induce nucleation. ***S. I. Kuznetsov and V. A. Derevyankin.*** *Croatica Chemica Acta*, v. 31, no. 4, 1959, p. 141-148.

10012* Investigation of the Conditions of the Co-precipitation of Germanium With Ferric Hydroxide. A small excess of NH_4OH is conducive to a complete co-precipitation of Ge, when there is an Fe - Ge ratio equal to 25 and above. The dependency of the Ge co-precipitation on the fullness of Fe precipitation, and the precipitation of Ge by a previously prepared ferric hydroxide were investigated. (*In Russian.*) Issledovanie uslovīĭ soosazhdeniia germaniia s gidratom okisi zheleza. ***Kh. Ia. Kuus.*** *Izvestiia Vysshikh Uchebnykh Zavedenīĭ, Khimiia i Khimicheskaia Teknologiia*, v. 3, no. 2, 1960, p. 235-238.

10013* Study of the Coprecipitation of Am and Eu With Lanthanum Oxalate. This coprecipitation depends on the cocrystallization with formation of mixed crystals. The value of the coefficient of crystallization does not depend on the acidity of the solution (from 0.1 to 1.5 *N* HNO_3) and, numerically, is equal to 3.8. The observed decrease of the value of the coefficient of crystallization with increase of the concentration of the oxalate ions in the solution must be connected with the decrease of the active concentration of $Eu^{(III)}$ because of the probable complex formation with the oxalate ion under the given conditions of the process. (*In Russian.*) Izuchenie soosazhdeniia Am i Eu s oksalatom lantana. ***V. I. Grevenshchikova and R. V. Bryzgalova.*** *Radiokhimiia*, v. 2, no. 2, 1960, p. 152-158.

10014* A Contribution to the Problem of the Existence of a Double Potassium and Barium Sulfate. The content per cent of potassium sulfate (5.5-6.7%) in a residue of barium sulfate obtained in a saturated potassium sulfate was determined. Carried away by the barium sulfate, the potassium sulfate is not washed out by water. The formation of solid solutions of $BaSO_4$ and K_2SO_4 with a low coefficient of distribution was suggested. (*In Russian.*) K voprosu o sushchestvovanii dvoĭnogo sul'fata kaliia i bariia. ***V. N. Bobrova.*** *Radiokhimiia*, v. 2, no. 2, 1960, p. 243-245.

10015 The Story of Chemistry. A history of chemistry from prehistoric times to the 20th century. Covers alchemy, iatrochemistry, and the branching of modern chemistry. ***Georg Lockemann.*** 277 pp. 1959. Philosophical Library, Inc., New York. (QD11 L79s)

10016 Mechanical Property Survey of Refractory Nonmetallic Crystalline Materials and Intermetallic Compounds. The literature on the mechanical properties of nonmetallic polycrystalline compounds and intermetallic compounds with melting points above 1500 C was surveyed. The theoretical concepts of flow and fracture were reviewed. It was concluded that the intermetallic compounds which are brittle at room temperature and slightly ductile at high temperature are more worthy of future study than the much worked-over oxides and interstitial compounds. ***William D. Smiley, et al.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 59-448, Jan. 1960, 308 pp. (TL507 Un3.18w Vis.)

10017 Synthesis of New High Temperature Materials. A number of mixed transition metal carbides, borides, and nitrides were prepared and examined in terms of melting point, structure, and oxidation resistance. An implosive-shock technique for compound synthesis, which subjects materials to extremely high temperature-pressure conditions for short periods of time, was developed. The method was used successfully to synthesize boron phosphide. ***J. L. Engelke, F. A. Halden, and E. P. Farley.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 59-654, Feb. 1960, 39 pp. (TL507 Un3.18w Vis.)

10018* Investigation of the Products of Reaction of Metallic Titanium With Titanium Tetrachloride. Metallic Ti at 300 C does not react with the tetrachloride in considerable amounts. The metal begins to react with chloride with formation of titanium trichloride. At 700 C and above titanium trichloride is sublimed. Titanium dichloride has two modifications, one occurs at 600 C and below. At higher temperatures first the same modification of titanium dichloride $TiCl_2$-1 is formed and then passes into $TiCl_2$-2, the second modification. (*In Russian.*) Issledovanie produktov vzaimodeistviia metallicheskogo titana s chetyrekhkhloristyn titanom. ***L. V. Biriukova and Iu. G. Saksonov.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 5, May 1960, p. 993-998.

10019* Oxidation of Cobalt Sulfide in the Presence of Sodium Chloride. In studying the process of oxidation of iron sulfide concentrate containing Co_3 it was found that NaCl fosters the transformation of Co into sulfate, which requires the presence of enough S in the initial material. A method for stimulating the process of oxidation of cobalt sulfide in poor S concentrates by introducing iron sulfide into the batch was developed. (*In Russian.*) Okislenie sul'fida kobal'ta v prisutstvii khloristogo natriia. ***A. Ia Zvorykin and F. M. Perel'man.*** *Zhurnal Prikladnoĭ Khimii*, v. 33, no. 4, Apr. 1960, p. 765-768.

10020* Investigation of the Conditions for Silicon Thermal Production of Lanthanum Silicide and Examination of Some of Its Properties. During Si reduction of lanthanum oxide in a vacuum, at low temperatures LaSi is formed which reacts with the excess Si, being partly converted into $LaSi_2$; at higher temperatures La_2O_3 is reduced to disilicide. Between 20 and 500 C lanthanum disilicide is a metallic conductor of the n-type; above, a semiconductor apparently of the p-type. (*In Russian.*) Issledovanie uslovīĭ kremnīĭtermicheskogo polucheniia silitsida lantana i nekotorykh ego svoĭstv. ***V. S. Neshpor and G. V. Samsonov.*** *Zhurnal Prikladnoĭ Khimii*, v. 33, no. 5, May 1960, p. 993-1001.

10021* Concerning the Problem of the Mechanism of the Reaction of Titanium Tetrachloride With Magnesium and of the Optimal Temperature Conditions of the Reduction Process. The reaction of reduction of Ti tetrachloride with Mn occurs in stages with formation of $TiCl_3$ and $TiCl_2$. The best development of the reaction in the gaseous or condensated phases is determined by the speed of the $TiCl_2$ supply to the reactor and by the partial pressure of the inert gas. The optimum temperature of reduction is between 930 and 940 C, since below, a crystallization from the $TiCl_2$ fusion is possible. (*In Russian.*) K voprosu o mekhanizme vzaimodeĭstviia chetyrekhkhloristogo titana s magniem i optimal'nom temperaturnom rezhime protsessa vosstanovleniia. ***R. A. Sandler.*** *Zhurnal Prikladnoĭ Khimii*, v. 33, no. 5, May 1960, p. 1013-1019.

10022* Study of the Solubility of K_2SO_4 and Na_2SO_4 in a Mixture of Alkali-Aluminate Solutions of Potassium and Sodium. In determining this solubility at different temperatures with application of the caustic modulus 3.6, a raise of temperature increased the solubility of the mixture of K and Na sulfates. Apart from temperature, the solubility of the sulfates and the K content are decreased with the increase of the K_2O_{tot} in the solution. The higher the K_2O_{tot} content in the solution, the lower the sulfate content (in SO_3). (*In Russian.*) Izuchenie rastvorimosti K_2SO_4 i Na_2SO_4 v smesi shchelochnoaliuminatnykh rastvorov kaliia i natriia. ***B. Kh. Shvartsman.*** *Zhurnal Prikladnoĭ Khimii*, v. 33, no. 5, May 1960, p. 1048-1052.

CHEMISTRY—ORGANIC

10023* On the Constitution of Phenolphthalein Oxime and Related Compounds. Phenolphthalein oxime is suggested to be a *p*-hydroxyanil of o-(*p*-hydroxybenzoyl) benzoic acid. Chemical evidence, infrared spectra, and polarographic data supporting the proposed constitution are presented. ***Henning Lund.*** *Acta Chemica Scandinavica*, v. 14, no. 2, 1960, p. 359-378.

10024* Some Reactions of Cyclohexanol in Contact With Activated Charcoal. The products of transformation of cyclohexane on activated coal in a H_2 and N_2 current between 200 and 500 C are cyclohexene, cyclohexanone, cyclohexane, benzene, phenol and diphenyl. A thermodynamic calculation of the equilibriums of a series of reactions in first and in zero approximations was carried out. There is a dismutation reaction of cyclohexanone on pure charcoal beginning at 200 C. (*In Russian.*) O reaktsiiakh tsiklogeksanola v kontakte s aktivirovannym uglem. ***A. A. Balandin, G. I. Levi, and E. L. Broude.***

Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk, 1960, no. 4, Apr., p. 614-623.

10025* Addition of Hydrogen Bromide to 1.1-Dichloropropene-2 in the Presence of Benzoyl Peroxide. A homolytic rearrangement of the radicals in the following scheme was observed: $CHCl_2CHCH_2Br \rightarrow CHClCHCl - CH_2Br$ with formation of 1.2-dichloro-3-bromopropane. (*In Russian.*) Prisoedinenie bromistogo vodoroda k 1,1-dikhlor-propenu-2 v prisutstvii perekisi benzoila. ***R. Kh. Freidlina, M. Ia. Khorlina, and A. N. Nesmeianov.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1960, no. 4, Apr., p. 658-661.

10026* Synthesis and Properties of p-Dialkyl-Benzenes. From p-dibromobenzene, by organomagnesium synthesis, a series of p-dialkyl-benzenes with normal structures of alkyl radicals were obtained. Their adhesivity properties and solidification points were studied. Dialkyl-benzenes with branched chains were obtained by two-stage synthesis (chloroalkylation of alkyl benzenes and further condensation with aldehydes, according to Grignard). (*In Russian.*) Sintez i svoĭstva paradialkilbenzolov. ***A. D. Petrov, G. I. Nikishin, and V. D. Vorob'ev.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1960, no. 4, Apr., p. 717-723.

10027 The Thermal Decomposition of Trialkylboranes. The disproportionation of trialkylboranes containing C_2 and C_4 alkyl substituents by heating to give unsaturated hydrocarbons and diborane-6 derivatives has been substantiated. ***Paul F. Winternitz and Arrigo A. Carotti.*** *American Chemical Society, Journal*, v. 82, May 20, 1960, p. 2430-2433.

10028 Diels-Alder Reactions of 9-Substituted Anthracenes. IV. 9-Nitroanthracene and 9-Anthramide. 9-Nitroanthracene gave both possible adducts with acrylic acid, acrylyl chloride, acrylonitrile and acrylamide in the Diels-Alder reaction. With allyl alcohol and methyl acrylate only one adduct was isolated. 9-Anthramide when heated with acrylic acid gave mainly 9,10-dihydro-9,10-ethanoanthracene-9,12-dicarboximide and some 9-carboxamido-9,10-dihydro-9,10-ethanoanthracene-1,1-carboxylic acid. ***John S. Meek, Donavan R. Wilgus, and John R. Dann.*** *American Chemical Society, Journal*, v. 82, May 20, 1960, p. 2566-2569.

10029 Steroidal Hormone Analogs. VI. Synthesis of 3'Acetyl-1',2':1,2-cyclopentano-1,2,3,4-tetrahydro-6-methoxynaphthalene. VII. Synthesis of Tricyclic Analogs Containing Nitrogen. VIII. Amino Acid Analogs of Some Artificial Estrogens. ***Norman A. Nelson, et al.*** *American Chemical Society, Journal*, v. 82, May 20, 1960, p. 2569-2580.

10030 The Radiation Chemistry of the Symmetrical Dichloroethylenes. Purified, degassed liquid samples of *cis-* and *trans-*1,2-dichloroethylenes were irradiated with He ions, electrons and γ-rays. A comparison of the radiolysis products was made with the products formed in the polymerization of these compounds with benzoyl peroxide. A mechanism is proposed to explain the formation of the observed products. ***Jean H. Futrell and Amos S. Newton.*** *American Chemical Society, Journal*, v. 82, June 5, 1960, p. 2676-2681.

10031 New Methods of Introducing the Carbo-*t*-Butoxy Protective Group. Preparation of *t*-Butyl Cyanoformate. Convenient synthesis of *t*-butyl carbazate from *t*-butyl S-methyl thiolcarbonate. Conversion of dihydroxamic acids to the corresponding carboxylic anhydrides by means of nitrous acid. ***Louis A. Carpino.*** *American Chemical Society, Journal*, v. 82, June 5, 1960, p. 2725-2727.

10032 Pantethine Analogs. The Condensation of Pantothenic Acid With Selenocystamine, With Bis-(β-aminoethyl) Sulfide and With 1,2-Dithia-5-azepane (A New Ring System). As part of a project concerned with the development of potential coenzyme a antagonists, the following compounds were synthesized: selenopantethine, bis(β-pantothenoylaminoethyl) sulfide and N-pantothenoyl-1,2-dithia-5-azepane. These compounds were prepared by the condensation of pantothenic acid with selenocystamine, bis-(β-aminoethyl) sulfide, and 1,2-dithia-5-azepane, respectively. The last compound represents a new heterocyclic system. ***Wolfgang H. H. Günther and Henry G. Mautner.*** *American Chemical Society, Journal*, v. 82, June 5, 1960, p. 2762-2765.

10033 The Cleavage of Sulfides and Sulfones by Alkali Metals in Liquid Amines. Organic sulfides and sulfones cleaved in good yields to the hydrocarbon and mercaptan or sulfinic acid by sodium in liquid ammonia and/or lithium in methylamine. The direction of this cleavage was established for a number of alkyl aryl and unsymmetrical diaryl sulfides and sulfones. ***William E. Truce, David P. Tate, and David N. Burdge.*** *American Chemical Society, Journal*, v. 82, June 5, 1960, p. 2872-2876.

10034 Diaryliodonium Salts. XIV. Reactions of Organometallic Compounds With Iodosobenzene Dichlorides and With Iodonium Salts. At low temperatures aryllithium compounds react with aryliodoso dichlorides in ether, tetrahydrofuran, or toluene to give 20-50% of diaryliodonium salts. More aryllithium compound or arylmagnesium halide converts the iodonium salt to a triaryliodine, from which the iodonium salt can be recovered in good yield by cleavage with acid. ***F. Marshall Beringer, Joseph W. Dehn, Jr., and Murray Winicov.*** *American Chemical Society, Journal*, v. 82, June 5, 1960, p. 2948-2952.

10035* Selectivity in the Hydrogenation of Oleic-Linoleic Acid Oils With Commercial Nickel Catalysts. Sesame oil was hydrogenated and the influence of temperature and catalyst self-poisoning was studied. The initial periods are not of the same length for the oleic and linoleic oil components. It was found that during the period of first-order kinetics a change in temperature has the same influence on the hydrogenation rate coefficients of the oleic and linoleic acid esters, which means that the activation energy per hydrogenated double bond is independent of the acid. ***Kaj Nielsen, Heinz J. M. Hansen, and Vagn R. Nielsen.*** *American Oil Chemists' Society, Journal*, v. 37, June 1960, p. 271-274.

10036* Catalyzed Esterification of Oleic Acid. The effects of type and concentration of catalyst and temperature on the rate of esterification of oleic acid with ethylene glycol was studied quantitatively. The catalysts used were salts of divalent metals. In addition, a study was made of the rate of the catalyzed esterification of oleic acid by a variety of mono- and polyhydric alcohols. ***L. H. Dunlap and J. S. Heckles.*** *American Oil Chemists' Society, Journal*, v. 37, June 1960, p. 281-285.

10037* Synthesis of Amino Acid Derivatives of Ethanolamine. N-Phthaloylglyclaminoethanol may be prepared in 24% yield by a modification of the Sheehan carbodiimide synthesis of peptides of hydroxy amino acids. ***Elizabeth C. Smith, P. M. Althouse, and James W. Shigley.*** *American Oil Chemists' Society, Journal*, v. 37, June 1960, p. 288-290.

10038* Aromatic Compounds From Pyrylium Salts. Substituted pyrylium salts may be used for the preparation of various difficulty-accessible aromatic compounds of the heterocyclic and isocyclic series. A review of the possibilities of synthesizing pyrylium salts. (*In German.*) Aromatische Verbindungen aus Pyryliumsalzen. ***K. Dimroth.*** *Angewandte Chemie*, v. 72, no. 10, May 21, 1960, p. 331-342.

10039* Concerning the Acid Hydrolysis of Hydroxyl-Containing Carbonic Acid Amides. A comparison between the acid hydrolysis of carbonic acid amides with that of hydroxy carbonic acid amides reveals that the speed of saponification is scarcely increased by means of an α-constant hydroxyl group, but is considerably augmented by means of a γ or δ-constant hydroxyl group. A comparison is drawn with the hydroxylsylpeptides. (*In German.*) Über die Säurehydrolyse hydroxylhaltiger Carbonsäureamide. ***Ludwig Zürn.*** *Annalen der Chemie (Justus Liebigs)*, v. 631, nos. 1-3, 1960, p. 56-60.

10040* Structure Parameters of Coal Based on Oxidation Tests. Oxidation tests revealed that the aromaticity (f_a) in the bituminous region increases constantly from 0.70 to 0.80. It increases rapidly only in the anthracite range and comes close to 1. The portion of aromatic hydrogen increases from 30 to 50% of the total hydrogen. In anthracite it exceeds 80%. The average size of the aromatic nucleus of coals in the bituminous range does not increase appreciably. The size of the aliphatic group corresponds probably to that of the methyl group. (*In German.*) Strukturparameter von Kohle auf Grund von Oxydationsversuchen. ***S. K. Chakrabartty, B. K. Mazumdar, S. N. Roy, and A. Lahiri.*** *Brennstoff-Chemie*, v. 41, no. 5, May 1960, p. 138-142.

10041* Reactions of Allyl Radicals With Olefins. A study has been made of the mechanisms of the reactions of allyl radicals, produced thermally from diallyl, with various hydrocarbons in the temperature range 460-506 C. The allyl radical is capable of abstracting hydrogen from certain hydrocarbons and of adding to olefinic double bonds at these temperatures. The rates of formation of the principal products in the reactions between allyl and l-butene, propylene, and ethylene are linearly related to the square root of the diallyl concentration. Mechanisms are proposed to account for the reaction products formed. ***W. A. Bryce and D. J. Ruzicka.*** *Canadian Journal of Chemistry*, v. 38, June 1960, p. 835-844.

10042* Radiation Chemistry of Cyclohexane. II. Dose Rate Effects on the Formation and Destruction of Cyclohexene. Prolonged radiolysis of cyclohexane leads to a steady-state concentration of cyclohexene where G(cyclohexene) = 0. At concentrations greater than this steady concentration, cyclohexene is destroyed. It is shown that this steady-state concentration is a function of dose rate, varying approximately as the fourth root of the radiation intensity. ***P. J. Dyne and J. W. Fletcher.*** *Canadian Journal of Chemistry*, v. 38, June 1960, p. 851-857.

10043* Aliphatic Chemistry of Fluorene. II. An Unusual Grignard Reaction. The reaction between methyl 9-methylfluorene-9-carboxylate and phenyl magnesium iodide gave 9,9′-dimethyl-9,9′-difluorenyl in almost quantitative yield. Evidence is presented which shows that 9-methylfluorene anion is an intermediate. The probable intervention of elemental iodine is discussed. ***P. M. G. Bavin.*** *Canadian Journal of Chemistry*, v. 38, June 1960, p. 882-889.

10044* Aliphatic Chemistry of Fluorene. III. Some Derivatives of Fluorene and Phenanthrene. IV. Preparation and Alkylation of Some Sulphides and Sulphones. Methyl fluorene-9-carboxylate and 9-methyl-9-acetylfluorene have been nitrated and the products converted to 2-nitrophenanthrene and 2-nitro-9,10-dimethylphenanthrene, respectively. Acetylation of 9,10-dimethylphenanthrene has given only one ketone, probably the 3-isomer. 4-Nitrofluorenone has been synthesized by a convenient route. The preparations are described of some 9-fluorenyl sulphides which have been oxidized with peracetic acid to the corresponding sulphones. 9-Fluorenyl *p*-tolyl sulphone has been alkylated with a range of alkyl halides; other sulphones, including 2-nitro-9-fluorenyl *p*-tolyl sulphone, have been methylated. ***P. M. G. Bavin.*** *Canadian Journal of Chemistry*, v. 38, June 1960, p. 911-922.

10045* Steroids. I. The Synthesis of Some Heterocyclic Steroid Derivatives. II. 6-Amino Steroids. III. Reduction of Oximinocholanic Acids. I.-II. ***Barbara G. Ketcheson and Alfred Taurins.*** III. ***Ted H. Waid and Alfred Taurins.*** *Canadian Journal of Chemistry*, v. 38, June 1960, p. 972-992.

10046 Acyl Isothiocyanates. IV. The Reaction Between Acetaldehyde Ammonia and Some Isothiocyanates. Products and mechanisms of the reaction are discussed. ***D. T. Elmore and J. R. Ogle.*** *Chemical Society, Journal*, 1960, May, p. 1961-1971.

10047 Liquid-Phase Photolysis. III. Isomerisation of Benzene and Some Benzene Derivatives to Fulvenes. Ultraviolet irradiation of benzene at 55° under N produces a partial isomerization to fulvene, apparently associated with $B_{2u} \leftarrow A_{1g}$ excitation, and irreversible under a variety of conditions. Analogous isomerizations were observed with toluene, isopropylbenzene, and anisole. ***H. J. F. Angus, J. McDonald Blair, and D. Bryce-Smith.*** *Chemical Society, Journal*, 1960, May, p. 2003-2007.

10048 The Kinetics and Mechanisms of Carbonyl-Methylene Condensations. VI. The Reaction of Malononitrile With Aromatic Aldehydes in Water. VII. The Reaction of Malononitrile With Aromatic Aldehydes in Ethanol. VIII. The Reaction of Ethyl Cyanoacetate With Aromatic Aldehydes in Ethanol, in Water, and in Ethanol-Water Mixtures. IX. The Reaction of Cyanoacetamide With Aromatic Aldehydes in Ethanol and in Water. VI.-VII. ***Saul Patai and Yigal Israeli.*** VIII. ***Saul Patai and Jacob Zabicky.*** IX. ***Saul Patai, Jacob Zabicky, and Yigal Israeli.*** *Chemical Society, Journal*, 1960, May, p. 2020-2044.

10049* The Addition Compounds of Bis-Salicylaldehyde Copper(II) and Its Derivatives With Pyridine and α,α′-Dipyridyl. II. Some Studies on the Structures. ***Yoneichiro Muto.*** *Chemical Society of Japan, Bulletin*, v. 33, no. 5, May 1960, p. 604-607.

10050* Possibilities of Oxidation of Cresols and Aromatic Amines With Selenium Dioxide. Protection of the phenolic hydroxy group in the m- and p-cresol through the benzene sulphonyl group, as well as of the amino group in the m- and p-toluidine through the phthalyl rest renders the selenium oxide oxidation of the methyl group of these compounds into the aldehyde- and carboxyl function in varying proportions possible. (*In German.*) Über die Möglichkeiten der Oxydation von Kresolen und aromatischen Aminen mit Selendioxyd. ***Géza Zemplén and Lajos Kisfaludy.*** *Chemische Berichte*, v. 93, no. 5, 1960, p. 1125-1128.

10051* Concerning the Action of Sulfur Dioxide on Diazo Compounds. III. Esters of the Sulfurous and Selenious Acid. Aliphatic diazo compounds react with alcoholic solutions of sulfur dioxide or selenium oxide with formation of "symmetrical" sulfurous or selenious acid esters. Mixed esters also are easily obtainable this way. Upon heating, they decompose with formation of the corresponding ethers. This occurs so easily with selenious acid esters, that a catalytic ethyrification of the alcohols is possible through the diazo compounds. (*In German.*) Über die Einwirkung von Schwefeldioxyd auf Diazoverbindungen. III. Ester der schwefligen und selenigen Säure. ***Gerhard Hesse and Suresh Majmudar.*** *Chemische Berichte*, v. 93, no. 5, 1960, p. 1129-1137.

10052* On Steroids. XLI. Epimeric 2-Bromo and 4-Bromo Derivatives of Cholestan-3-One. The preparation of epimeric 2-bromo and 4-bromo derivatives of cholestan-3-one has been described. The starting bromohydrines were prepared by cleavage of the corresponding epoxides, and reactions, necessary for the proof of structure of the substances described, have been carried out. The infrared spectra and optical rotations of bromo ketones are discussed. ***I. Malunowicz, J. Fajkos, and F. Sorm.*** *Collection of Czechoslovak Chemical Communications*, v. 25, no. 5, May 1960, p. 1359-1370.

10053* On Terpenes. CVIII. Epimeric Aromadendrenes. Stereoisomerism of Ledol, Viridiflorol and Globulol. CIX. A Contribution to the Structure of Absinthin and Anabsinthin. CX. A Contribution to Stereochemistry of Absinthin and Artabsin. CVIII. ***L. Dolejš, O. Motl, M. Souček, V. Herout, and F. Sorm.*** CIX-CX. ***L. Novotný, V. Herout, and F. Sorm.*** *Collection of Czechoslovak Chemical Communications*, v. 25, no. 5, May 1960, p. 1483-1505.

10054* Study of the Thermal Decomposition of Metallic Formiates and Oxalates. The study of the nature of the atmosphere on the thermal decomposition of Fe, Co, and Ni oxalates was extended to Mn, Cu, and Zn oxalates and formiates of the six metals. (*In French.*) Étude de la décomposition thermique de formiates et d'oxalates métalliques. ***Jean-Louis Dorémieux and André Boullé.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 250, no. 19, May 9, 1960, p. 3184-3186.

10055 Synthesis of DL-Cystine S^{35}. Description of DL cystine S^{35} synthesis, starting from hydrogen sulphide S^{35}, in four stages with an over-all yield of 63%. (*In French.*) Synthèse de la DL-cystine ^{35}S. ***M. Herbert, R. Emiliozzi, and L. Pichat.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1286, 1959, 7 pp. (QC770 F84.2r Contin.)

10056* Photometric Investigation of the Reaction of Titanium (IV) With Phenols in Acetic Acid. All the compounds investigated, except Ti chromotropic and gallic acids, are formed only in concentrated acetic acid. The complex of Ti with chromotropic acid is decomposed in concentrated acetic acid. The analytic determination of Ti with chromotropic acid can lead to a wide interval of acetic acid concentrations. The isomolar series method is used in determining the composition of Ti chromotropic complex in 27-75% acid with Ti chromotropic acid equal to 1:4. (*In Russian.*) Fotometricheskoe issledovanie reaktsii titana (IV) s fenolami v uksusnoĭ kislote. ***S. Ia. Shnaiderman.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Khimiia i Khimicheskaia Tekhnologiia*, v. 3, no. 2, 1960, p. 258-264.

10057* Selective Hydration of Aldehydes Into Alcohols. A process for the hydration of butyraldehyde and of a mixture of C_9 - C_8 and C_{12} - C_{17} aldehydes into alcohols was studied. The dependence of the depth of hydration of the aldehydes and the yield of alcohols on the pressure, temperature and volumetric speed of the raw material supplied was determined. Optimum conditions for two variants of the process (at 150 and 300 at.) were found. (*In Russian.*) Selektivnoi gidrirovanie al'degidov v spirty. ***S. Z. Levin and A. Z. Karpov.*** *Izvestiia Vysshikh Uchebnykh Zavedenīi, Khimiia i Khimicheskaia Tekhnologiia,* v. 3, no. 2, 1960, p. 364-368.

10058* Paper Chromatography and Structural Relationships of Organic Acids. An acidic and a basic solvent containing the same proportions of propanol and water have been used for the study of about 100 organic acids by paper chromatography. The R_M values of the organic acids in the two solvents can be arranged into clear-cut groups dependent on the number of carboxyl and other substituted groups present, in such a way that the number of carboxyl groups in an unknown acid can be confidently predicted. An indication can also be obtained of other groups such as alkyl, aryl, amino, hydroxy, bromo etc. which may be present, and the manner in which they are arranged. ***J. R. Howe.*** *Journal of Chromatography,* v. 3, no. 5, May 1960, p. 389-405.

10059 Free Radical Rearrangements in the Decarbonylation of Aldehydes. The reaction of β-deutero-β-(*p*-anisyl)-β-phenylpropionaldehyde with di-*t*-butyl peroxide has been found to give decarbonylation without rearrangement of the deuterium atom. A reinvestigation of the decarbonylation of β,β,β-triphenyl-propionaldehyde has shown that in addition to the 1,1,2-triphenylethane previously reported there are present lesser amounts of triphenylethylene and 3,3-diphenyl-1-indanone. ***David Y. Curtin and James C. Kauer.*** *Journal of Organic Chemistry,* v. 25, June 1960, p. 880-885.

10060 Reactions of *t*-Butyl Peresters. II. The Reactions of Peresters With Compounds Containing Activated Hydrogens. The reactions of *t*-butyl peresters with esters, ethers, aldehydes, ketones, tetralin, benzyl alcohol, dimethylaniline, and thiophenol were investigated. Cuprous bromide exerts a marked influence on both the nature and the rate in most of these reactions, and some of these reactions may be applied advantageously for preparative purposes. ***George Sosnovsky and N. C. Yang.*** *Journal of Organic Chemistry,* v. 25, June 1960, p. 899-903.

10061 γ-Radiation-Induced Addition of Aldehydes to Esters of Maleic, Fumaric, and Acetylenedicarboxylic Acids. The γ-radiation (Co-60) initiated addition of aldehydes to maleates and fumarates gives acylsuccinates identical with those obtained with peroxide initiation. The reaction has been extended for the first time to additions with isobutyraldehyde and to the addition of aldehydes to acetylenedicarboxylates. Both radical and radiation initiation give products having a 2,3-diacyl structure from the acetylenedicarboxylates. ***Richard H. Wiley and J. R. Harrell.*** *Journal of Organic Chemistry,* v. 25, June 1960, p. 903-904.

10062 2-Substituted 1,3-Indandiones. Various 2-aryl- and 2-acyl-1,3-indandiones were prepared. ***R. L. Horton and K. C. Murdock.*** *Journal of Organic Chemistry,* v. 25, June 1960, p. 938-941.

10063 Synthesis of Several Fluorinated Cyclobutanes and Cyclobutenes. The synthesis of several fluorinated cyclobutanes by cyclization of $CF_2{=}CX_2$ olefins with themselves, and other olefins is reported. It appears that this cycloaddition takes place quite readily and easily only when X is halogen. The physical properties of the fluorinated cyclobutanes and fluorinated cyclobutenes are described. ***J. D. Park, H. V. Holler, and J. R. Lacher.*** *Journal of Organic Chemistry,* v. 25, June 1960, p. 990-993.

10064 Addition of Alcohols to Fluorinated Ethylenes. The sodium alkoxide-catalyzed addition of primary alcohols to 1-bromo-2,2-difluoro-, 1,1-dibromo-2,2-difluoro-, and 1-bromo-1,2,2-trifluoroethylene has been studied. Properties of the products and infrared data are reported. ***Arieh Demiel.*** *Journal of Organic Chemistry,* v. 25, June 1960, p. 993-996.

10065 Structure of Molten Mercuric Halides. IV. Mercuric Bromide-Alkali Metal Bromide Mixtures. An investigation of the cryoscopy of molten $HgBr_2$ having Li, Na, K, Rb and Cs/Br as solutes. ***George J. Janz and Jerome Goodkin.*** *Journal of Physical Chemistry,* v. 64, June 1960, p. 808-811.

10066* Complex Formation of Carbamide Using Water as an Activator. In the presence of water as activator the complex formation studied occurs according to the conditions of application of crystalline carbamide, even when the water content does not exceed 10%. This technique can be applied successfully in industry, in particular for the production of ceresin from petrolatum. (*In Russian.*) Kompleksoobrazovanie karbamida s primeneniem vody v kachestve aktivatora. ***I. Batori.*** *Khimiia i Tekhnologiia, Topliv i Masel,* v. 5, no. 5, May 1960, p. 21-26.

10067* Alkylation of Toluene by Means of C_{10} Olefins in the Presence of Sulfuric Acid. The effect of the following factors on the intensity of the reaction of sulfuric acid alkylation of toluene by C_{10} olefins, presenting dimers of amylenes, were studied: strength of the initial acid between 85 and 100% weight on monohydrate; temperatures between −10 and +40 C time between 0.5 and 90 min; a molar toluene-olefins relationship of 0.5-10, a volumetric acid-hydrocarbon relationship of 0.05-0.5. (*In Russian.*) Alkilirovanie toluola olefinami C_{10} v prisutstvii sernoĭ kisloty. ***Iu. I. Kozorezov and A. Z. Dorogochinskiĭ.*** *Khimiia i Tekhnologiia, Topliv i Masel,* v. 5, no. 5, May 1960, p. 36-41.

10068* The Structural and Mechanical Properties of Bitumens From Different Oxidation Processes. A study of the structural and mechanical properties of bitumens obtained from three different processes, by means of batch stills, emulsion and emulsion-cavitation apparatus, has revealed the merits of the emulsion-cavitation method. With the latter, the asphalts are oxidized at rates exceeding by 40 times those in batch stills and the bitumens obtained are endowed with superior rheological properties. (*In Russian.*) Strukturno-mekhanicheskie svoĭstva razlichno okislennykh bitumov. ***A. I. Ivanov and N. V. Mikhaĭlov.*** *Kolloidnyĭ Zhurnal,* v. 22, no. 2, Mar.-Apr. 1960, p. 176-185.

10069* Zinc Borotartrate. A new zinc borotartrate compound $3ZnO.B_2O_3.2C_4H_4O_5.3H_2O$ was obtained. It consists of a solution containing boric acid, potassium hydroxide and zinc sulfate with the molecular ration $C_4H_6O_6{:}H_3BO_3$ + 2 and more, *p*H = 7-8 and more than 11. At a lower *p*H, zinc borotartrate is not formed, but precipitates of acid potassium tartrate are developed. (*In Russian.*) Borotartrat tsinko. ***E. Shvarts, A. Ievin'sh, and M. Zil'ber.*** *Latvijas PSR Zinātnu Akademijas Vestis,* 1960, no. 4, p. 105-108.

10070* Copper Catalyzed Oxidation of Glycocol Solutions With Periodate. Study of the Cu-catalyzed oxidative deamination of glycocol at 100 C and in a 1 *N* KOH medium revealed that the oxydative deamination of the Cu-(II) glycocol complexes is firmly connected with the decomposition of H_2O_2. The mechanism of the deamination can be explained according to A. Goudot's interpretation. In the catalytic deamination process of glycocol, there is a Cu^{2+}– Cu^{2+} transfer. (*In Hungarian.*) Lúgos glikokoll oldatok rézzel katalizált perjodátos oxidációja. ***Kováts Zoltán.*** *Magyar Kémiai Folyóirat,* v. 66, no. 5, May 1960, p. 181-187.

10071* New Polysaccharide Gums Produced by Microbial Synthesis. Two new gums—Phosphomannan Y-2448 and Polysaccharide B1459—are obtained from cheap and readily available raw materials and have a wide range of potential uses including pharmaceuticals, cosmetics, polishes and adhesives. *Manufacturing Chemist,* v. 31, May 1960, p. 206-208.

10072* A New Reaction of Cyclic Aliphatic Anhydrides. Cyclic aliphatic anhydrides on treatment with catalytic amounts of a tertiary amine undergo a reaction with the evolution of CO_2. The evolution of CO_2 is preceded by the appearance of a red to purple intermediate. The products are brittle and amorphous, soluble in polar solvents and in alkali, insoluble in nonpolar solvents and acid. ***D. Rittenberg and Laura Ponticorvo.*** *National Academy of Sciences, Proceedings,* v. 46, June 1960, p. 822-824.

10073* New Reactions of 1,1- and 1,2-Disubstituted Hydrazines. ***C. G. Overberger.*** *Record of Chemical Progress,* v. 21, no. 1, Mar. 1960, p. 21-47.

10074* The Chemistry of the N-Alkylaldimines. I. The Reaction of N-Alkylaldimines With Acetic Anhydride. N-Alkyladimines add on acetic anhydride with the formation of the corresponding N-alkyl-N(1-acetoxyalkyl)-acetamides, which readily split off acetic acid to yield N-alkyl-N(1-alkenyl)-acetamides as the final products. ***H. Breederveld.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 79, May 1960, p. 401-407.

10075* Studies in IVth Group Organometallic Chemistry. V. Preparation of Some *p*-Styrenyl-Substituted Derivatives of Germanium, Tin and Lead. The preparation of triphenyl-mono- and diphenyldi-*p*-styrenyl derivatives of Ge, Sn and Pb is described. The infrared spectra of these compounds are discussed. ***J. G. Noltes, H. A. Budding, and G. J. M. van der Kerk.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 79, May 1960, p. 408-412.

10076* The Ionization and Coordination Behaviour of Porphyrins. Acid and base properties of porphyrins and metallo-prophyrin complexes are discussed. ***J. N. Phillips.*** *Reviews of Pure and Applied Chemistry*, v. 10, no. 1, Mar. 1960, p. 35-60.

10077* Coal: The Mineral of Carbon; "Carbonurgie". The use of coal has been reduced by hydraulic energy, oil and nuclear energy. Only 1% of the coal mass is used in the burning process. Pilot plant tests show that up to 80% of the coal weight could be used in the form of new substances, such as anthraxylic acid, soluble compounds with large molecules, new aromatic compounds, and that coal could be associated with derivatives of petroleum or with heavy materials such as rubber. (*In French.*) La houille: minerai de carbone; la "carbonurgie". ***Alfred Gillet.*** *Revue Universelle des Mines*, v. 16, ser. 9, May 1960, p. 213-226.

10078* Action of Bromine in the Presence of Ether-Oxides. Ethyl oxide and certain homologs are bromination catalysts in the aromatic series. A monovalent O function can produce Br^+ ions, after momentary formation of bromalcoyl-oxonium bromide, if the +I effects do not cause a rupture of the C-O link. (*In French.*) Action du brome en présence d'éthers-oxydes. ***Roger Pajeau.*** *Société Chimique de France, Bulletin*, 1960, no. 4, Apr., p. 621-622.

10079* A Study of the Thermal Decomposition of Some Metallic Oxalates. Oxalates were decomposed either in a vacuum or in an inert gas current. The trend of the total process is determined by the speed of decomposition of the salt and by the speed of reduction of the metallic oxide formed by the oxide of carbon produced. The composition of the metal + oxide mixture obtained depends upon these speeds. The metals often are pyrophoric. (*In French.*) Étude de la décomposition thermique de quelques oxalates métalliques. ***Robert David.*** *Société Chimique de France, Bulletin*, 1960, no. 4, Apr., p. 719-736.

10080* Effects of the Recovery of the Ester-Aldehyde Fraction on the Fermentation Process. When introducing this fraction in a fermenting medium early in the process, the formation of similar products is considerably reduced, whereas the technical end characteristics of fermentation are improved and the alcohol yield from one ton of conventional starch is increased. The additions containing the ester aldehyde fractions, when these fractions are added to a fermenting medium during fermentation, undergo complex changes. (*In Russian.*) Vliianie vozvrata efiro-al'degidnoĭ fraktsii na protsess brozheniia. ***S. P. Guliaev.*** *Spirtovaia Promyshlennost'*, v. 26, no. 4, 1960, p. 10-15.

10081 Technique of Organic Chemistry. II. Physical Methods of Organic Chemistry. A comprehensive presentation of the techniques which are used in the organic laboratory and which are available for the investigation of organic compounds is presented. Describes the theoretical background for an understanding of the various methods and operations; techniques and tools, their modifications, merits, limitations, and handling. ***Arnold Weissberger, editor.*** v. I. 3rd Ed. 902 pp. 1960. Interscience Publishers, Inc., New York. (QD453 W44p3)

10082 Effect of Cis-Trans Isomerism on the Urea Inclusion Compound Forming-Ability of a Molecule; a Study of the Maleate-Fumarate System. Several maleates and fumarates were investigated to determine their ability to form urea inclusion compounds. Olefinic esters of both acids will form inclusion compounds. However, the shortest chain required to stabilize a particular ester was related to the over-all cross-sectional diameter of the ester. The fumarates, having the more slender conformation form complexes more readily than the maleates. ***Jack Radell, Joseph W. Connolly, and William R. Cosgrove, Jr.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Note* 59-407, Feb. 1960, 11 pp. (TL507 Un3.18t Contin.)

10083* Contributions to the Chemistry of Silicon and Germanium. IV. On the Preparation of Crude Silane. The process used is a further development of the Stocks method by acid-decomposition of magnesium silicide. Instead of hydrochloric acid, sulfuric acid 25% is used, and instead of hydrogen, purest nitrogen is used as the inert-gas. The temperature of the reaction is noticeably higher and lies at about 100 C. The addition of the silicide is done by means of a worm shaft and is automatically regulated by a contact-manometer. (*In German.*) Beiträge zur Chemie des Siliciums und Germaniums. IV. Über die Darstellung des Rohsilans. ***F. Fehér, G. Kuhlbörsch, and H. Luhleich.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 303, nos. 5-6, Mar. 1960, p. 283-293.

10084* Investigation of the Mechanism of Electrical Conductivity and Photoconductivity of Organic Dyestuffs (Photographic Sensitizing and Desensitizing Dye Stuffs). (*In German.*) Untersuchungen über den Mechanismus der elektrischen Leitfähigkeit und der Photoleitfähigkeit organischer Farbstoffe (Photographische Sensibilisierungs- und Desensibilisierungsfarbstoffe). ***R. Matejec.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 24, nos. 1-2, Apr. 1960, p. 24-36.

10085* Correlations in the Substitution of Benzene Hydrogen by Alkyl Groups. VII. The Ratio Between the Rate Constants of Formation of Isopropylbenzenes and Equations for the Composition of the Products of Benzene Alkylation by Propylene in the Presence of Aluminum Chloride. The ultimate product of benzene alkylation by propylene in the presence of $AlCl_3$ at 60 C has been shown to be tetraisopropylbenzene. The ratio of the rate constants of formation of alkylbenzenes on successive alkylation of benzene by propylene has been found to be: $k_1':k_2':k_3k_4' = 1:0.58:0.24:0.015$. The equations for the composition of the system have been calculated for various molar ratios of propylene—benzene. (*In Russian.*) Zakonomernosti zameshcheniia atomov vodoroda v benzol'nom iadre alkil'nymi gruppami. VII. Sootnoshenie mezhdu konstantami skorosti obrazovaniia izopropilbenzolov i uravneniia sostava produktov alkilirovaniia benzola propilenom v prisutstvii khloristogo aliuminiia. ***V. G. Pliusnin, E. P. Babin, M. I. Nasakina, and N. M. Rodigin.*** *Zhurnal Fizicheskoĭ Khimii*, v. 34, no. 2, Feb. 1960, p. 267-271.

10086* New Methods for the Synthesis of O-Peptides. The two well known methods for the synthesis of the peptide bond (the carbodiimide method and the method of mixed anhydrides with phosphorus oxychloride) can be successfully applied to the synthesis of O-peptides. (*In Russian.*) Novye metody sinteza O-peptides. ***L. A. Shchukina, S. N. Kara-Murza, and R. G. Vdovina.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 4, Apr. 1960, p. 1139-1143.

10087* Synthesis and Pyrolysis of Alkylarsinic Acid Esters. The thermal decomposition of alkyl esters of alkyl arsinic acids leads to the formation of two As-containing products: alkylarsinic acid ester and trialkyl arsenite. The reaction is accompanied by formation of alcohol with a radical entering into the alkoxy-group of the initial alkylarsinic acid ester. (*In Russian.*) Sintez i piroliz efirov alkilarsinovykh kislot. ***Gil'm Kamaĭ and B. D. Chernokal'skiĭ.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 4, Apr. 1960, p. 1176-1180.

10088* Acylation of Arene Sulfamides by Acetoacetic Acid Esters and Their Substitutes. The reaction of the alkaline salts of arenesulfamides with esters of acetoacetic, chloro-, ethyl-, dichloro- and diethylacetic acids was studied. The following were synthesized N-dichloroacetylbenzenesulfidamide, N-dichloroacetil-n-toluenesulfidamide, and N-dichloracetyl-n-chlorobenzenesulfide. (*In Russian.*) Atsilirovanie arensul'famidov efirami atsetouksusnoĭ kisloty i ee zameshchennykh. ***A. E. Kretov and E. A. Abrazhanova.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 4, Apr. 1960, p. 1243-1245.

10089* Some Properties of Ethers of Dialkylarsinic Acids. The method described is based on the oxidation of correspond-

ing ethers of dialkyl arsinic acids by SeO_2. The first representatives of the alkyl ethers of the acids studied were obtained and the atomic recification of As in these compounds was calculated. (*In Russian.*) Nekotorye svoĭstva efirov dialkilarsinistykh kislot. ***Gil'm Kamaĭ and B. D. Chernokal'skiĭ.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 5, May 1960, p. 1536-1541.

10090* Reactions of Oleic and Stearic Acid With Sulfur. The kinetics of the reaction of fatty acids with S and thiuram above 120 C with the production of some hydrogen sulfide were described. There is a positive effect of the fatty acids on the rubber vulcanization processes, on their acceleration but not on their deceleration as previously claimed. (*In Russian.*) Vzaimodeĭstvie oleinovoĭ i stearinovoĭ kislot s seroĭ. ***I. T. Taranenko.*** *Zhurnal Prikladnoĭ Khimii*, v. 33, no. 5, May 1960, p. 1203-1207.

CHEMISTRY—PHYSICAL

10091* Conductometric Study of Bismuth Precipitation by Means of Pyrophosphate. When titrating bismuth nitrate by means of a highly alkaline pyrophosphate, a basic salt was obtained $(BiO)_2H_2P_2O_7 \cdot 2H_2O$. When the pyrophosphate was slightly alkaline $Bi_4(P_2O_7)_3$ was obtained. Early during titrations, as long as Bi was in large excess and the medium was acid due to the hydrolysis of the bismuth nitrate, a product containing much Bi was precipitated (3Bi for $1P_2O_7^{4-}$). (*In Rumanian.*)

Studiu conductometric al precipitării bismutului cu pirofosfat. ***C. Drăgulescu, D. Ceauşescu, and D. Lazăr-Jucu.*** *Academia Republicii Populare Romîne. Baza de Cercetări Ştiinţifice Timisoara. Studii şi Cercetări Ştiinţifice. Seria Ştiinţe Chimice*, v. 5, nos. 3-4, July-Dec. 1958, p. 11-18.

10092* Carbide Thermal Reduction of Magnesium. II. Thermal Reduction of Dolomite by Calcium Carbide. The optimal conditions of reduction are: 1200 - 1250 C, a testing period of two hours, a vacuum about 1 mm Hg, a stoichiometrical amount of calcium carbide in the batch, the presence of CaF_2 as a catalyst (2-3%). The maximum Mg yield obtained with 1200 C, a three hours period, a 0.02 - 0.09 mm Hg vacuum, the presence of CaF_2, is 91.61%. It is 74.00% in the absence of the catalyst. (*In Russian.*) Karbidotermicheskoe vosstanovlenie magniia soobshchenie. II. O termicheskom vosstanovlenii dolomita karbidom kal'tsiia. ***M. V. Darbinian.*** *Akademiia Nauk Armianskoi SSR, Izvestiia, Seriia Khimicheskikh Nauk*, v. 12, no. 6, 1960, p. 389-405.

10093* Investigation of the $Ti(SO_4)_2$ - H_2SO_4 - NaOH - H_2O System (20 and 25 C) by Solubility Method and the Method of Apparent Volume of the Precipitate. In the system studied in the weak solutions the process of formation of the precipitate according to the increase in the amount of alkali consists of three stages: the coprecipitation of H_2SO_4 with H_2TiO_3, the neutralization in the H_2SO_4 precipitate by the NaOH solution to form free H_2TiO_3, and the coprecipitation of NaOH with H_2TiO_3. (*In Russian.*) Issledovanie sistemy $Ti(SO_4)_2$ - H_2SO_4 - NaOH - H_2O (20 i 25°) metodami rastvorimosti i kazhushchegosia ob"ema osadka. ***A. I. Ul'ianov.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1960, no. 4, Apr., p. 580-587.

10094* Sorption of Sulfate Complexes of Zirconium by Highly Alkaline Anion Exchange Apparatus. Zirconium sorption in a strong alkaline anion exchange in a sulfate anion medium was studied. The possibility to use the sorption of complex compounds of Zr by means of ion exchange resins for different analytical and preparative purposes in inorganic chemistry was revealed. Sorption is very selective and the sorbed element can easily be forced out of the column by usual mineral acids. (*In Russian.*) Sorbtsiia sul'fatnykh kompleksov tsirkoniia sil'no shchelochnym anionoobmennikom. ***Vatslav Shlapek.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1960, no. 4, Apr., p. 599-604.

10095 Kinetics of the Reduction of Nitrobenzenes by Sodium Disulfide. The reduction of nitrobenzene by sodium disulfide to aniline has been studied kinetically at 60, 50, 40 and 30° in 70 and 40 vol. % aquous methanolic solutions using an ultraviolet spectrophotometer. The rate was found to be proportional to the concentration of nitrobenzene and to the square of the concentration of sodium disulfide. ***Masaru Hojo, Yasuo Takagi, and Yoshiro Ogata.*** *American Chemical Society, Journal*, v. 82, May 20, 1960, p. 2459-2462.

10096 Alumina: Catalyst and Support. III. The Kinetics and Mechanisms of Olefin Isomerization. Deals with the kinetics of isomerization of 3,3-dimethylbutene and of isomeric *n*-butenes over certain aluminas. ***Werner O. Haag and Herman Pines.*** *American Chemical Society, Journal*, v. 82, May 20, 1960, p. 2488-2494.

10097 The Thermodynamic Stability of Porphyrinogens. Uroporphyrinogen rapidly isomerizes in hot acid solution to a random mixture of isomers, yet the reduced porphyrin can be recovered in high yield. An explanation for the thermodynamic stability of this macrocycle based on the chelate effect is offered. ***D. Mauzerall.*** *American Chemical Society, Journal*, v. 82, May 20, 1960, p. 2601-2605.

10098 The Kinetics of the Homogeneous Gas Phase Thermal Decomposition of Ozone. Homogeneous gas phase decomposition of concentrated ozone was studied manometrically over the pressure range 11.3 to 51.8 mm at temperatures of 115, 120, 125, and 130°. ***J. A. Zaslowsky, H. B. Urbach, F. Leighton, R. J. Wnuk, and J. A. Wojtowicz.*** *American Chemical Society, Journal*, v. 82, June 5, 1960, p. 2682-2686.

10099* Ultraviolet Spectroscopy Using Polarized Light. The absorption spectra in the ultraviolet and visible range are an important aid for the coordination of an absorption band, if in addition to the energy (frequency) and intensity of the band the steric orientation of the particular electron oscillator in the molecule is known. Offers a review on the methods for the determination of this orientation and a description of the measurement and explanation of the degree of polarization of the fluorescent light, when the latter is energized by means of polarized light and in different absorption bands. (*In German.*) Ultraviolett-Spektroskopie mit polarisiertem Licht. ***Friedrich Dörr and Manfred Held.*** *Angewandte Chemie*, v. 72, no. 9, May 7, 1960, p. 287-294.

10100 Electrophilic Catalysis in Nucleophilic Substitution and Elimination. II. Kinetics and Mechanisms of Reaction of t-Butyl Chloride With Pyridine, Tribenzylamine, Radio-Chloride Ions and Hydrogen Radio-Chloride in Nitromethane. Measurements are reported on the kinetics of elimination from and radio-chloride exchange in t-butyl chloride in nitromethane. The elimination of hydrogen chloride in the presence of pyridine, tribenzylamine, or low concentrations of tetraethylammonium chloride has the characteristics of a unimolecular process. ***Y. Pocker.*** *Chemical Society, Journal*, 1960, May, p. 1972-1977.

10101 The Rôle of Supports in Catalytic Hydrogenation. I. Specific Effects of Various Oxide Carriers on the Activity of Platinum. Zirconia and thoria have been found to act as highly active promoters when used as supports for Pt in the liquid-phase hydrogenation of cyclohexene at room temperature. The activity of the complex catalyst containing a fixed amount of Pt first rises to a peak value and then falls with increasing amount of the support, the peak activity corresponding, with zirconia, to about 16 times that of the unsupported Pt and, with thoria, to about 12 times this value. ***E. B. Maxted and Sayeed Akhtar.*** *Chemical Society, Journal*, 1960, May, p. 1995-1998 + 1 plate.

10102* Relations Between Electronic Absorption Spectra and Spatial Configurations of Conjugated Systems. X. Benzaldehyde, Acetophenone and Related Compounds. XI. Styrene, 1, 1-Diphenylethylene and Their Methylated Derivatives. ***Hiroshi Suzuki.*** *Chemical Society of Japan, Bulletin*, v. 33, no. 5, May 1960, p. 613-628.

10103* Solubility in Liquid Ammonia of the Gas Mixture N_2+3H_2). Presents an instrument for determining solubilities of gas in liquid ammonia. Data relating to the solubility of a synthetic gas (N_2+3H_2) in ammonia between −50 and +50 C, under pressures of 100, 300, and 500 kg/cm² were determined. Composition of the dissolved gas was determined. (*In French.*) Solubilité du mélange gazeux (N_2+3H_2) dans l'ammoniac liquide. ***B. Lefrançois and C. Vaniscotte.*** *Chimie & Industrie (Génie Chimique)*, v. 83, no. 5, May 1960, p. 139-145.

10104* Solubility of Zein in the Binary Mixture of Water and Ethanol. (*In French.*) Solubilité de la zéine dans le mélange binaire eau-éthanol. ***Jacques Mossé.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 250, no. 20, May 16, 1960, p. 3323-3325.

10105 A Kinetic Study of the Decomposition of Monomeric Nitrosomethane. The rate of disappearance of gaseous monomeric nitrosomethane is studied by a flow technique. It is shown that the reaction is first order and is partly heterogeneous and partly homogeneous. The influence of surface and of certain inert additives is examined, and it is also shown that nitric oxide reacts with nitrosomethane. ***L. Batt and B. G. Gowenlock.*** *Faraday Society, Transactions,* v. 56, May 1960, p. 682-690.

10106* Equilibrium Concentrations of Water Vapors, of Compressed Oil and of Diethylene Glycol in Compressed Natural and Commercial Gases. In all the systems considered, the weight concentration of the substance dissolved in the compressed gas increases with the increase of temperature and pressure. In some cases, the processes of reverse concentration and evaporation of the substance dissolved in the gas are clearly marked. In compressed gases the balanced concentration of the water vapors increases also with the increase of the ethane content in the gas mixture and with the amount of hydrocarbons of a higher boiling point. (*In Russian.*) Ravnovesnye kontsentratsii parov vody kompressornogo masla i dietilenglikolia v szhatykh prirodnykh i promyshlennykh gazakh. ***O. N. Atrakovich.*** *Gazovaia Promyshlennost',* 1960, no. 5, May, p. 7-11.

10107* Potentiometric Studies on the Dissociation of Gallic Acid. Determination, employing potentiometric method, of the dissociation constants of gallic acid in the range 30-80 C; these have been employed for calculating the thermodynamic functions such as changes in free energy, entropy, etc., associated with the dissociation of gallic acid. ***N. A. Ramaiah and R. K. Chaturvedi.*** *Indian Academy of Sciences, Proceedings,* v. 51, sec. A, no. 4, Apr. 1960, p. 177-188.

10108* Spectral Investigation of the Nitrobenzene-Benzidine System. There are loosely linked complex compounds of a 1:1 composition with a constant 0.1 1/mol equilibrium, and of a 2:1 composition with a 0.015 l^2/mol^2 equilibrium. The region of absorption of these complexes were distributed and the energy of the bond determined. (*In Russian.*) Spektral'noe issledovanie sistemy nitrobenzol-benzidin. ***V. D. Gol'tsev.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Fizika,* 1960, no. 2, p. 21-25.

10109* Effects of the Concentration of a Dispersion Phase on the Full Characteristic of the Dispersion of a Suspension. The effect of this concentration on the sedimentation stability in a suspension of quartz, barium sulfate, calcite and graphite was studied by the sedimentometric characteristic of the particle distribution. (*In Russian.*) Vliianie kontsentratsii dispersnoĭ fazy na polnuiu kharakteristiku dispersonosti suspenzīĭ. ***N. A. Figurovskii and T. B. Gavrilova.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Khimiia i Khimicheskaia Tekhnologiia,* v. 3, no. 2, 1960, p. 295-300.

10110* Vibrational Spectra of Crystalline *n*-Paraffins. I. Methylene Rocking and Wagging Modes. Infrared spectra of crystalline *n*-paraffins from *n*-$C_{20}H_{42}$ through *n*-$C_{30}H_{62}$ are reported. It is found that to an excellent approximation, the frequencies of methylene rocking and wagging modes are a function of a single parameter. This parameter is related to the phase difference, σ, in the motion between two adjacent methylene groups of a given chain. ***Robert G. Snyder.*** *Journal of Molecular Spectroscopy,* v. 4, no. 5, May 1960, p. 411-434.

10111* Sublimation Pressures of Solid Solutions. I. The Systems Tin(IV) Bromide-Tin(IV) Iodide and Tin(IV) Bromide-Titanium(IV) Bromide. The System Tin(IV) Bromide-Tin(IV) Iodide-Carbon Tetrachloride. ***James J. Kearney and Norman O. Smith.*** *Journal of Physical Chemistry,* v. 64, June 1960, p. 737-742.

10112 Kinetics of the Catalytic Vapor Phase Oxidation of Phthalic Anhydride. Oxidation of phthalic anhydride over vanadium oxide catalyst was studied between 497 and 575° in a flow system. The rate of oxidation was independent of the oxygen partial pressure above 0.1 atm but varied with phthalic anhydride partial pressure in a manner similar to a unimolecular surface reaction. ***Mack F. Hughes and Robert T. Adams.*** *Journal of Physical Chemistry,* v. 64, June 1960, p. 781-784.

10113* Precipitation of a Unipolar Charged Aerosol in a Closed Room. Experiments were made on the precipitation of a unipolar aerosol in a chamber 1.2 m^3 capacity. The charge was induced by atomizing the liquid in an electrical field. The theoretical and experimental results approximately agree if it is assumed that the charges are distributed among the droplets proportionally to the radius of the latter. (*In Russian.*) Osazhdenie unipoliarno zariazhennogo aerozolia v zakrytom pomeshchenii. ***V. F. Dunskiĭ and A. V. Kitaev.*** *Kolloidnyĭ Zhurnal,* v. 22, no. 2, Mar.-Apr. 1960, p. 159-167.

10114* Investigation of Adsorption Surges. I. Reduction of Anthraquinone-1-Sulfonic Acid on Dropping Mercury Electrodes. Due to the change of the Hg level, of the temperature and of the depolarization, the surge of the more positive potential depends upon the diffusion, whereas the surge of the more negative potential is connected with the adsorption. (*In Hungarian.*) Adszorpciós hullámok vizsgálata. I. Antrakinon-1-szulfonsav redukciójának vizsgálata csepegó higany elektródon. ***Péter Ferenc, Rusznák István, Pályi Gyula, and Szabados Ida.*** *Magyar Kémiai Folyóirat,* v. 66, no. 5, May 1960, p. 178-181.

10115* The Condensation of Ethylene Oxide on Phenol. The first step of the addition of ethylene oxide to phenol in the presence of sodium phenolate was investigated kinetically. In contrary to the previous, insufficient formulation via anionic intersteps the course of reaction can be described quantitatively by a mechanism involving the formation of complexes. The difference in the stability of the complexes of the concurring associates determines the selective behavior of reaction of the first addition step. (*In German.*) Die Kondensation von Äthylenoxyd an Phenol. ***Franz Patat and Bernhard Wojtech.*** *Makromolekulare Chemie,* v. 37, nos. 1-2, Apr. 1960, p. 1-18.

10116* Effects of Side Reactions of the Initiator Radicals on the Polymerization Process. Some of the radicals formed during the decomposition of the initiator (azo-bis-isobutyronitrile) start chains, while the remainder are consumed by side reactions. A quantitative consideration of these side reactions requires a recalculation of the rate constants and activation energies of propagation and termination. (*In German.*) Die Beeinflussung des Polymerisationsablaufs durch Nebenreaktionen der Initiatorradikale. ***G. Henrici-Olivé and S. Olivé.*** *Makromolekulare Chemie,* v. 37, nos. 1-2, Apr. 1960, p. 71-84.

10117* Investigations on the Reduction of Uranium (IV) Fluoride by Liquid Aluminium in Molten Salt Mixtures. The reduction process in salt baths containing chlorides proceeds easily but is slow in fluoride salt baths. Discusses the chemical reactions occurring in the mentioned salt mixtures and a reaction scheme responsible for obtaining liquid aluminum-uranium alloys containing 20-30 and more w-%/° uranium. (*In Polish.*) Badania nad redukcja fluorku uranu (IV) cieklym glinem w stopach solnych. ***W. Trzebiatowski, A. Bogacz, and I. Barycka.*** *Nukleonika,* v. 4, no. 6, 1959, p. 591-598.

10118 The Principles of Electrophoresis. General properties of electrolytes, colliodal systems, electrokinetic potential and electrophoresis, determination of particle mobilities, the moving-boundary method, electrophoresis in supporting medium, techniques of paper electrophoresis and other problems are discussed. ***René Audubert and Serge de Mende.*** 142 pp. 1959. The Macmillan Co., New York. (QD563 Au29ptr)

10119* Study of the Effects of Complex Formation in Fusion on the Coefficient of Crystallization in the $PbCl_2$ - $ThXCl_2$ - KCl and $CaCl_2$ - $CdCl_2$ - KCl Systems. On the basis of a study of the distribution of $ThXCl_2$ and $CdCl_2$ between the fusion and the $PbCl_2$ and $CaCl_2$ crystals, it is shown that in solutions also the formation of a complex compound in the liquid phase leads to the increase of the value of the coefficient of crystallization. (*In Russian.*) Izuchenie vliianiia kompleksoobrazovaniia v rasplave na koeffitsient kristallizatsii v sistemakh $PbCl_2$ - $ThXCl_2$ - KCl i $CaCl_2$ - $CdCl_2$ - KCl. ***V. R. Klokman, K. G. Miakishev, and V. S. Smirnov.*** *Radiokhimiia,* v. 2, no. 2, 1960, p. 175-182.

10120* Physical Properties of Organic Thiones. I. Electronic Absorption Spectra of Nitrogen-Containing Thione Compounds. II. Electronic Absorption Spectra of Compounds Containing the Thiocarbonyl Groups. ***M. J. Janssen.***

Recueil des Travaux Chimiques des Pays-Bas, v. 79, May 1960, p. 454-473.

10121* A Comparative Study of Ion-Exchange Equilibria in Triphosphate and Copper Triphosphate Solutions. Triphosphate ion is sorbed with an average charge of 4.4 or 3.8 according to the initial ion on the exchanger. ***Carla Heitner-Wirguin.*** *Research Council of Israel, Bulletin*, v. 9A, nos. 1-2, Apr. 1960, p. 37-42.

10122* Study of the Hydrogen Bond in the Butyl Alcohol *n*-Butylamine *n* Complexes by Means of Nuclear Magnetic Resonance. The N.M.R. spectra of mixtures of *n*-butylamine and *n*-butylalcohol and of their solutions in benzene show a common peak for the protons of both the NH_2-group and the OH-group. This is due to a fast exchange between these protons which arises through the medium of the complex RNH_2—HOR. The own shift of this complex seems situated at about 2 p.p.m. from the H_2O peak. This indicates a non-ammoniacal structure of the complex. (*In French.*) Étude de la liaison hydrogène dans les complexes butanol *n*-butylamine *n* par résonance magnétique nucléaire. ***P. Huyskens and Th. Zeegers-Huyskens.*** *Société Chimique de Belgiques, Bulletin des Sociétés Chimiques Belges*, v. 69, nos. 5-6, May-June 1960, p. 267-281.

10123* Thiocyanates and Isothiocyanates. Equilibrium, Kinetics and Mechanisms of Isomerization. Observations which may have considerable mechanistic significance. ***A. Hiceto, A. Fava, and U. Mazzucato.*** *Tetrahedron Letters*, 1960, no. 11, May, p. 27-35.

10124* Investigation of the Reaction of Potassium Ferrocyanide and N-Phenyl Lepidinium Perchlorate in Aqueous Solution by the Electrical Conductivity Method. The study of the electrical conductivity of isomolar sulfurs of aqueous solutions of these systems was conducted in the presence of hydrochloric acid and without it. In its presence a compound of the constant composition 1 mole of $K_4[Fe(CN)_6]$ for four moles of $C_{16}H_{14}NClO_4$ is formed. In its absence there is no reaction between the components. (*In Russian.*) Issledovanie vzaimodeĭstviia zhelezistosinerodistogo kaliia i n-fenillepidiniĭperkhlorata v vodnom rastvore metodom elektroprovodnosti. ***D. P. Belotskii and B. M. Gutsuliak.*** *Ukrainskĭ Khimicheskĭ Zhurnal*, v. 26, no. 2, 1960, p. 158-160.

10125* Tris-(Trimethylsilyl) Amine. The Raman- and infrared-spectra of this compound and those of methyl-trimethylsilyl-amine, dimethyl-trimethylsilyl-amine, bis-(trimethylsilyl)-amine, and methyl-bis-(trimethylsilyl)-amine are reported and the frequencies assigned. It is assumed that the bond forces of the N-Si bonds are higher than 1.0; presumably the group NSi_3 is not completely planar. (*In German.*) Tris-(trimethylsilyl)-amin. ***J. Goubeau and J. Jiménez-Barberá.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 303, nos. 5-6, Mar. 1960, p. 217-226.

10126* A Study of the Mechanism of the Electrolytic Chromium Deposition by Reduction of Chromic Acid. In the mechanism suggested, the last step is the reduction of a monomolecular oxidic surface layer into metallic Cr. The action of the "foreign ions" consists first in preventing the growth in thickness of the oxide layer, owing to a parallel dissolving reaction. At the same time the ions inhibit the development of H_2 and correspondingly increase the electrolytic efficiency for the Cr deposition. (*In German.*) Zum Mechanismus der elektrolytischen Chromabscheidung durch Reduktion von Chromsäure. ***M. Käppel and H. Gerischer.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 64, no. 2, Apr. 1960, p. 235-244.

10127* Investigations of the Crystal Structure of Phenol. Phenol crystallizes monoclinically with six molecules in the cell. The molecules are connected by means of H bridges with endless chains in the a-direction. Two chains with three links each are in the elementary region. The O-H-O chains are spiral. The structure is pseudorhombic. (*In German.*) Untersuchungen zur Kristallstruktur des Phenols. ***C. Scheringer, O. J. Wehrhahn, and M. v. Stackelberg.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 64, no. 3, May 1960, p. 381-386.

10128* The Catalytic Efficiency of Photographically Developed Silver for the Reduction of Silver Complexes. Photographic emulsions were allowed to develop in the initial stage for several periods of time and then fixed. From the resulting Ag threads, Ag was separated from citrate complexes during a second development. The speed of reduction found in the case of shortly developed layers passes through a sharp maximum. It is determined by the reduction and the insertion of Ag in the nucleus. (*In German.*) Die katalytische Wirksamkeit von photographisch entwickeltem Silber für die Reduktion von Silberkomplexen. ***Hermann Eggenschwiller and Walther Jaenicke.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 64, no. 3, May 1960, p. 391-394.

10129* Concerning Interfacial Processes During Material Exchange Between Carbon Dioxide and an Unmoved Liquid. Absorption and desorption processes between CO_2 as gas phase and water, as well as decalin in the liquid phase were studied. Without additional stirring, during absorption there is a convection-conditioned process of saturation with an exponential time law. During desorption there is pure diffusion proportional to $\sqrt{Dt}$. With additional stirring, desorption is exponential, yet considerable differences in the time constants continue in both directions. (*In German.*) Über die Grenzflächenvorgänge beim Stoffaustausch zwischen Kohlendioxyd und einer unbewegten Flüssigkeit. ***Bernhard Ilschner.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 64, no. 3, May 1960, p. 441-451.

10130* The Crystal Structure of Tetracyanoethylene. Tetracyanoethylene forms monoclinic crystals whose structure was determined with the aid of a sharpened three-dimensional Patterson synthesis and was refined by least-squares methods. ***D. A. Bekoe and K. N. Trueblood.*** *Zeitschrift für Kristallographie*, v. 113, Apr. 1960, p. 1-22.

10131* Measurement of Fluorescence on Thin Films of Aromatic Hydrocarbons. A method is described which applies the principle of the Ulbricht ball for the measurement of the emission of fluorescence of thin, in high-vacuum prepared, films of aromatic hydrocarbons. Fluorescence spectra of thin films of anthracene, tetracene, pyrene and of perylene were measured by this method at room temperature and compared with the spectra of their solutions. The observed differences are briefly discussed. (*In German.*) Fluoreszenzmessungen an dünnen Filmen aromatischer Kohlenwasserstoffe. ***H. -H. Perkampus.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 24, nos. 1-2, Apr. 1960, p. 1-10.

10132* Infrared Spectra of Hydrogen and Deuterium Chemisorbed on Platinum. In previous work bands attributable to hydrogen chemisorbed on metals were not observed despite many attempts to detect them. Although the "negative" nature of this evidence was realized, it was tentatively interpreted to mean that chemisorbed hydrogen is not covalently bonded to single surface metal atoms in structures of the type, *M—H*. Bands attributable to hydrogen chemisorbed on carrier supported platinum were observed. This shows that above interpretation must be modified for some cases. ***W. A. Pliskin and R. P. Eischens.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 24, nos. 1-2, Apr. 1960, p. 11-23.

10133* The Intensity of Electron Transfer Bands in Electron-Donor-Acceptor Complexes. A function is derived which connects the extinction coefficient for the maximum of electron transfer bands, ϵ_{max}, with $h\nu_{max}$ and with the resonance energy of the complexes, R_N. (*In German.*) Die Intensität von Elektronenüberführungsbanden in Elektronen-Donator-Akzeptor-Komplexen. ***G. Briegleb and J. Czekalla.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 24, nos. 1-2, Apr. 1960, p. 37-54.

10134* Electron Interaction and Heat of Adsorption During Chemisorption of Gases on Evaporation Deposited Metalfilms. I. Adiabatic Calorimeter for Simultaneous Measurement of Heat of Adsorption and Resistance of Films. The construction and calibration of an adiabatic calorimeter for the simultaneous measurement of the heat of adsorption and the change of the electrical resistance of a metalfilm, deposited by evaporation, is described. An example of chemisorption of oxygen on a nickel-film is discussed. (*In German.*) Elektronische Wechselwirkung und Adsorptionswärme bei der Chemisorption von Gasen an aufgedampften Metallfilmen. I. Adiabatisches Kalorimeter zur gleichzeitigen Messung von Adsorptionswärme und Filmwiderstand. ***G. Wedler.*** *Zeitschrift*

für Physikalische Chemie (Frankfurt), v. 24, nos. 1-2, Apr. 1960, p. 73-86.

10135* Contributions to the Kinetics and to the Mechanism of the Dark Addition Chlorination of Benzene. The dark addition chlorination of benzene, which proceeds in a heterogeneous mixture of benzene-water in the presence of chlorine and of hypochloric acid or of such substances which together with chlorine yield hypochloric acid, was investigated. It was hereby found that the reactions which proceed in general in the aqueous as well as in the non-aqueous phase of this mixture, do not affect the additional chlorination and the formation of hexachlorocyclohexane. (*In German.*) Beiträge zur Kinetik und zum Mechanismus der additiven Dunkelchlorierung des Benzols. ***K. Schwabe and G. Gebhardt.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 24, nos. 1-2, Apr. 1960, p. 87-102.

10136* The Equilibrium of Phases in the Systems H_2-*n*-Heptane, H_2-Methylcyclohexane and H_2-2,2,4-Trimethylpentane at Higher Pressures and Temperatures. The composition of the coexisting phases of the systems H_2-*n* heptane, H_2-methylcyclohexane and H_2-2,2,4-trimethylpentane in the pressure range up to 1000 kp/cm^2 at temperatures from 150 to 230° was determined by the static method. The solubility is at a given temperature and pressure about equal for *n*-heptane and 2,2,4-trimethylpentane, but is considerably lower for methylcyclohexane. (*In German.*) Das Phasengleichgewicht in den Systemen H_2-*n*-Heptan, H_2-Methylcyclohexan und H_2-2,2,4-Trimethylpentan bei höheren Drucken und Temperaturen. ***S. Peter and K. Reinhartz.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 24, nos. 1-2, Apr. 1960, p. 103-118.

10137* The Mechanism of Hydrogen-Deuterium-Exchange on Nickel. The measurements were carried out at 100-165 C. The apparent activation energy is 7.5 kcal/Mol. (*In German.*) Zum Mechanismus des Wasserstoff-Deuterium-Austausches an Nickel. ***G. -M. Schwab and E. Killmann.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 24, nos. 1-2, Apr. 1960, p. 119-129.

10138* Concerning the Atomic Arrangement in the Solid State of the Aluminum-Zinc System. The atomic distribution of the solid Al-Zn system was determined by means of the diffuse X-ray low angle scattering. In the region studied (12 to 50 atom % Zn, 340 to 380 C) generally equivalent neighbors are preferred (cluster formation). The highest excess of equivalent neighbors for the critical concentration exists with 380 C (about 30 C above critical temperature). With decreasing temperature the short range order increases. (*In German.*) Über die Atomanordnung in festem Zustand des Systems Aluminium–Zink. ***A. Münster and K. Sagel.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 24, nos. 3-4, May 1960, p. 217-239.

10139* On the Most Rational Approaches to the Specific Heat Properties of Aqueous Solutions of Electrolytes. The potentialities of applying the apparent thermal capacities of electrolytes, which are negative quantities, in elucidating the laws and physical sense of ion-solvent water interaction in solutions are very restricted. New, positive thermal capacity functions have been proposed, which in the author's belief are capable of giving a direct and more rational approach to some aspects of the general problem of aqueous electrolyte solutions. (*In Russian.*) K voprosu o ratsional'nykh putiakh izucheniia teploemkostnykh svoĭstv vodnykh rastvorov elektrolitov. ***A. P. Rutskov.*** *Zhurnal Fizicheskoĭ Khimii*, v. 34, no. 4, Apr. 1960, p. 734-741.

10140* Studies of the Thermodynamic Properties of Liquid Metal Solutions. The System Potassium-Lead. The values of the partial and integral thermodynamic values for the system K-Pb have been calculated over a large range of concentrations (0.05 to 0.9 N_K) and temperatures (500-600 C) from the emf's of the concentration cells K/glass/K-Pb alloy. Large negative deviations from the ideal values have been explained by the existence in liquid alloys of structural groups of metallic compounds. (*In Russian.*) Issledovanie termodinamicheskikh svoĭstv zhidkikh metallicheskikh rastvorov. Sistema kaliĭ-svinets. ***M. F. Lantratov.*** *Zhurnal Fizicheskoĭ Khimii*, v. 34, no. 4, Apr. 1960, p. 782-788.

10141* The Dielectric Constant of Some Organic Compounds Over a Broad Temperature Range. The dielectric constants of methyl *o*-methoxybenzoate, *o*-acetoxybenzoic acid, salipyrine and benzophenone have been measured in the liquid and supercooled states over the temperature range 200-400 K at external field frequencies $1.72 \cdot 10^6$ H_3/sec. The over-all and orientation polarizations as well as Kirkwood's coeffiicent have been calculated over the same temperature range. (*In Russian.*) Dielektricheskaia pronitsaemost' nekotorykh organicheskikh soedineniĭ v shirokom intervale temperatur. ***A. V. Komandin and A. K. Bonetskaia.*** *Zhurnal Fizicheskoĭ Khimii*, v. 34, no. 4, Apr. 1960, p. 845-849.

10142* Solvate Forms of Zirconium and Hafnium Nitrates With Tributyl Phosphate. The use of reaction constants of the formation of complexes of $HNO_3 \cdot TBF$ and $HNO_3 \cdot 2TBF$ makes it possible to calculate very exactly the passage of nitric acid into TBF within a wide range of concentration of HNO_3 and its salts. There are two sulfates of Zr and Hf nitrates with TBF - $Me(NO_3)_4 \cdot 2TBF$, forming at a different concentration of TBF in the organic phase. (*In Russian.*) O sol'vatnykh formakh nitratov tsirkoniia i gafniia s tributilfosfatom. ***G. F. Egorov, V. V. Fomin, Iu. G. Frolov, and G. A. Iagodin.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 5, May 1960, p. 1044-1050.

10143* Effects of the Nature of the Solvent on the Formation of Rhodanide Complexes of Bivalent Mercury. The complexes were formed in aqueous, acetone, methanol and also mixed with water, and were studied by the potentiometric method. $Hg(CNS)_4^{2-}$ is formed in an aqueous solution in the range of concentration of KCNS 2.4 -3.4 mol/1. The constants of dissociation of the complexes of $Hg(CNS)_4^{2-}$ $Hg(CNS)_3^{-}$ and $Hg(CNS)_2^{0}$ in the corresponding solvents were calculated. (*In Russian.*) Vliianie prirody rastvoritelia na obrazovanie rodanidnykh kompleksov dvukhvalentnoi rtuti. ***A. M. Golub and L. I. Romanenko.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 5, May 1960, p. 1085-1089.

10144* Mechanism of the Extraction of Uranium (VI) Tributylphosphate From Hydrochloric Acid Solutions. An analysis of the organic phase and a study of the relationship between the coefficient of distribution and the composition of aqueous and organic phases revealed that in TBF concentrations in the organic phase between 0.040 and 0.734 mol/1, U (VI) is extracted from hydrochloric acid solution by means of TBF solutions in inert diluents, especially in the form of the complex $UO_2Cl_2 \cdot 2TBF$. (*In Russian.*) O mekhanisme ekstraktsii urana (VI) tributilfosfatom iz solianokislykh rastvorov. ***V. B. Shevchenko, I. G. Slepchenko, V. S. Shmidt, and E. A. Nenarokomov.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 5, May 1960, p. 1095-1099.

10145* Physico-Chemical Investigation of the Solutions of Some Monoatomic Alcohols in Acetone. The viscosity, density, critical temperatures and latent heat of evaporation of methyl, ethyl, propyl and butyl alcohols in acetone were studied. Concentration dependence of the energy of activation of the viscous flow, and calculations revealed that the reaction between the molecules of the alcohols and of the acetone is lower than the reaction between the molecules of the alcohols, but higher than the reactions between the molecules of the acetone. (*In Russian.*) Fiziko-khimicheskoe issledovanie rastvorov nekotorykh odnoatomnykh spirtov v atsetone. ***R. F. Mocharniuk.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 4, Apr. 1960, p. 1081-1086.

10146* Energetic Yield of Nitric Acid Decomposition Under the Effects of Ionizing Radiations. In studying the relationship between the energy yield of N_2O, NO and NO_2 decomposition under the influence of ionizing radiations and the pressure (0-1.5 atm), temperature (0-400 C) and intensity of radiation (up to 10^{17} e.v./cm^2.sec) it was found that the degree of resistance of NO, N_2O and NO_2 to the action of the radiations was contrary to the degree of their resistance to the action of high temperature. (*In Russian.*) Energeticheskiĭ vykhod razlozheniia okislov azota pod deĭstviem ioniziruiushchikh izlucheniĭ. ***M. T. Dmitriev, L. V. Zaradzev, and M. A. Mininovich.*** *Zhurnal Prikladnoĭ Khimii*, v. 33, no. 4, Apr. 1960, p. 808-814.

10147* Equilibrium Between Pyridine Vapors and Acid Solutions of Pyridine Sulfate. By a distillation method it is possible to measure the pressure of pyridine vapors at 30-55 C

over pyridine sulfate solutions containing different amounts of sulfuric acids of pyridine sulfate and ammonium sulfate. Formulas were obtained for the calculation of the pressures of pyridine vapors over solutions containing 5-44 g/l of pyridine, 0.2-2% free sulfuric acid, containing no ammonium sulfate. (*In Russian.*) Ravnovesie mezhdu parami piridina i kislymi rastvorami sulfata piridina. ***I. N. Kuz'minykh and A. G. Kuznetsova.*** *Zhurnal Prikladnoi Khimii*, v. 33, no. 4, Apr. 1960, p. 865-870.

10148* Thermodynamic Properties of Liquid Metallic Solutions of the Zn-Bi and K-Cd Systems. An electrodynamic force method was used. The Zn-Bi system was studied at 420 - 800 C in an interval of N_{Zn} concentrations of 0.144 - 0.9664. The K - Cd system was studied at 475 - 575 C in a range of N_K concentrations of 0.025 - 0.95. Higher positive deviations from the Raul Law in liquid metallic Zn - Bi solutions were observed by the formation in the melt of structural groups of pure constituents (stratification in the system). (*In Russian.*) Termodinamicheskie svoĭstva zhidkikh metallicheskikh rastvorov sistem Zn - Bi and K - Cd. ***M. F. Lantratov and E. V. Tsarenko.*** *Zhurnal Prikladnoĭ Khimii*, v. 33, no. 5, May 1960, p. 1116-1128.

COATINGS

10149* Positional Isomers Formed During the Hydrogenation of Methyl Oleate. ***R. O. Feuge and E. R. Cousins.*** *American Oil Chemists' Society, Journal*, v. 37, June 1960, p. 267-271.

10150 Improved Method for Measuring Abrasion Resistance of Coatings. Improvements made in a National Bureau of Standards method for measuring the above have significantly increased the speed, ease, and precision of the measurements. *American Paint Journal*, v. 44, June 20, 1960, p. 24 + 1 page.

10151 Water-Soluble Baking Resins From Trimellitic Anhydride. These resins and an aliphatic dicarboxylic acid offer practical water-thinned industrial enamels with high gloss, good flexibility and impact resistance, high hardness, and good mar resistance. ***Benjamin A. Bolton and Richard E. Van Strien.*** *American Paint Journal*, v. 44, June 20, 1960, p. 71 + 6 pages.

10152* Test of Paints for Water Tank Interiors. Tests started in December, 1950. Vinyl systems were superior to all others tested, regardless of surface preparation (all blast-cleaned surfaces) pretreatments, or brand of material used. ***John D. Keane and Joseph Bigos.*** *American Water Works Association, Journal*, v. 52, May 1960, p. 623-630.

10153* Use of Polyphosphates for Developing Protective Calcite Coatings. Encouraging experiments were initiated with calcium and iron carbonates because of their wide use in water supply practice for protection against corrosion. ***Robert F. McCauley.*** *American Water Works Association, Journal*, v. 52, June 1960, p. 721-734.

10154* Low Molecular Weight Polyethylenes in Paperboard Coatings. Above are used for board coatings because they are readily dissolved in wax and can be run on conventional equipment. Polyethylene improves gloss, gloss retention, blocking, abrasion, chemical resistance and tensile strength. ***Robert Rosenbaum.*** *Applied Plastics*, v. 3, June 1960, p. 34-37.

10155* Bureau of Reclamation. Tests and Evaluates Coatings for Dam Projects. Evaluation of new products and special tests are discussed to show the Bureau's use of tests for selections of new materials. Emphasizes importance of proper application of coatings under field conditions. *Corrosion*, v. 16, June 1960, p. 9 + 3 pages.

10156* Procedures and Techniques for Internal Cleaning and Coating of Plant Piping In-Place. *Corrosion*, v. 16, June 1960, p. 15 + 4 pages.

10157* Industrial Application of Zinc-Filled Inorganic Coatings. Compared to organics in resistance to corrosives, surface preparation, under-surface corrosion. Materials are considered especially suitable for environments in southern areas near salt water. *Corrosion*, v. 16, June 1960, p. 24 + 3 pages.

10158* Relation of Molecular Structure and Pigments to Coating Performance. Discusses the main components of coatings, with emphasis on their characteristics related to these components. *Corrosion*, v. 16, June 1960, p. 32 + 3 pages.

10159* Industrial Maintenance Painting Program. A Report of NACE Technical Unit Committee T-6D on Industrial Maintenance Painting, Prepared by Task Group T-6D-3 on Paint Programs. Outlines current industrial practices in establishing and sustaining industrial maintenance painting programs. *Corrosion*, v. 16, June 1960, p. 135-138.

10160 Red Lead and White Lead for Protection of Iron and Steel. Covers the composition of the various types of red and white lead systems to aid in selection. ***A. G. Walker.*** *Corrosion Technology*, v. 7, May 1960, p. 139 + 3 pages.

10161* Studies of Adhesion Phenomena in Rubber to Metal Bonding With Leikonat Glue. III. Interaction Between Sodium Butadiene Rubber and Triphenylmethane Triisocyanate. A study of Leikonat shows that the viscosity of the rubber solutions increases by several magnitudes on addition of 3–5% isocyanate. After a given time period, three-dimensional structures develop. (*In Russian.*) Issledovanie adgesionnykh iavleniĭ pri kreplenii reziny k metal u kleem "Leĭkonat". III. Vzaimodeĭstvie natriibutadienovogo kauchuka s triizotsianattrifenilemtanom. ***A. M. Medvedeva, B. V. Deriagin, and S. K. Zherebkov.*** *Kolloidnyĭ Zhurnal*, v. 22, no. 2, Mar.-Apr. 1960, p. 217-222.

10162 Organic Finishes. A guide to selection and specification of finishes for common metal surfaces: Finishing materials, materials compatibility, finishing costs, specification factors, surface preparation, finish application methods. ***R. G. Murphy.*** *Machine Design*, v. 32, June 9, 1960, p. 136-147.

10163* Lacquering Techniques for Vacuum Metalizing on Metals and Thermosetting Plastics. Physical and chemical properties of the plating system are being steadily improved. As a result of this and other developments in the equipment field, vacuum metalizing is believed to be passing a major milestone where much more rapid expansion in the use of this process will be seen in coming years. ***M. A. Self.*** *Metal Finishing*, v. 58, May 1960, p. 40-43.

10164* Spray-Applied Decorative Dispersion Coatings for Metal Products. Variations of plastisol and organosol effects may be achieved apart from color and texture. These include surface gloss, spatter and multi-color effects, as well as metal tones. With these variables available, the possibilities offered by vinyl dispersion coatings appear to be almost limitless. ***Harold Preuss.*** *Metal Finishing*, v. 58, May 1960, p. 44 + 2 pages.

10165* Synthetic Polymers of Petroleum Origin for Coatings. Hydrocarbon polymers and polar modifications of them can be used in many ways to form converting finishes. Conversions are readily accomplished over a wide temperature range and with interesting chemical modifiers. ***D. F. Koenecke and W. L. Van Nostrand, Jr.*** *Official Digest*, v. 32, June 1960, p. 832-855.

10166* New Developments in the Soluble Vinyl Aromatic/-Diene Copolymer Paint Resin Field. ***Donald A. Hilliard.*** *Official Digest*, v. 32, June 1960, p. 856-879.

10167* Theoretical Considerations of the Stability of Dispersions of Solids in Organic Liquids. Factors of stability are not independent of each other, and the question of stability is appraised in terms of the relationship and interactions between them. The importance of molecular polarity is stressed. ***Max Bender.*** *Official Digest*, v. 32, June 1960, p. 880-887.

10168* Measuring Paint Thickness Using the Electronic Method. Nondestructive technique gives quick and accurate readings of paint films on various metals. *Paint and Varnish Production*, v. 50, no. 7, June 1960, p. 39 + 1 page.

10169* Bonding of Exterior Latex House Paints to Chalky Wood Surfaces. Deals with the adequacy of the binder, penetration of the binder, and dry time of the binder. ***Temple C. Patton.*** *Paint and Varnish Production*, v. 50, no. 7, June 1960, p. 43-48.

10170* Problems in Filling Aerosol Paints. ***E. G. Roberts.*** *Paint and Varnish Production*, v. 50, no. 7, June 1960, p. 95-97.

10171 Advanced Paint Chemistry. X. Hydrocarbon, Vinyl and Acrylate Polymers. An account of the chemistry of hydrocarbon resins and polymers, including synthetic rubber, is followed by a review of vinyl, allyl, acrylic and methacrylic polymers. ***Phillip M. Fisk.*** *Paint Manufacture*, v. 30, June 1960, p. 198-200.

10172 Polyester Resins in Wood Finishes. II. Techniques used in the application of polyester lacquers are discussed. ***L. H. Allan.*** *Paint Manufacture*, v. 30, June 1960, p. 203-206.

10173* The Characteristics of Asphalt Enamels. ***Lloyd F. Bramble.*** *Pipe Line News*, v. 32, June 1960, p. 27 + 1 page.

10174* Post-Irradiation Thermal and Electrical Properties of Magnet Wire Insulation. Some 20 coating compositions are investigated. ***John W. Kallander.*** *Power Apparatus and Systems*, 1960, no. 47, Apr., p. 42-49.

10175* Factors Affecting the Aging Characteristics of Various Wire Coating Materials in Transformer Oil. ***C. F. Lipsey and P. W. Juneau, Jr.*** *Power Apparatus and Systems*, 1960, no. 47, Apr., p. 73-77.

10176* Flame-Ceramic Process Applies High-Temperature Coatings. Applications in power engineering requiring resistance to high temperatures, abrasion, chemicals. ***George R. Sylvester.*** *Power Engineering*, v. 64, June 1960, p. 97 + 2 pages.

10177 Structure and Properties of Thin Films. Formation, mechanical properties, electrical properties, and magnetic properties of thin films; chemical interactions at surfaces are discussed. ***C. A. Neugebauer, J. B. Newkirk, and D. A. Vermilyea, editors.*** Proceedings of an International Conference held at Bolton Landing, New York on Sept. 9-11, 1959. 561 pp. 1959. John Wiley & Sons, New York. (QC183 In8s)

10178 Protective Coatings for Refractory Metals. Work showed that oxygen-free atmospheres, but not high vacuum conditions, were required for the successful application of ceramic coatings on W. ***Clifton G. Bergeron, et al.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 59-526, Jan. 1960, 44 pp. (TL507 Un3.18w Vis.)

10179 Velocity Measurements of Flame-Sprayed Aluminum Oxide Particles. Velocities were determined with a high-speed cinecamera, a streak camera, and a rotating disc velocimeter. ***Dwight G. Moore, Warren D. Hayes, Jr., and Alfred W. Crigler.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-658, pt. 1, Oct. 1959, 15 pp. (TL507 Un3.18w Vis.)

10180* Paints for Underwater Use (Antifouling Paints). Deals with the loads to which the coatings are exposed, the requirements to be met by the paints destined for underwater use, and the qualitative assessment of the different agents. (*In German.*) Anstriche für Unterwasserbeanspruchung. ***K. A. van Oeteren.*** *Werkstoffe und Korrosion*, v. 11, Apr. 1960, p. 209-212.

10181* Ditridecyl Phthalate (DTDP) in High Temperature Vinyl Insulation. Phthalates based on oxo alcohols meet most vinyl insulation needs. Tridecyl alcohol esterifies readily with phthalic anhydride. DTDP-plasticized vinyl insulation passes the heat-aging requirements for 90° and 105° wire. ***William A. Dimler, Jr.*** *Wire and Wire Products*, v. 35, May 1960, p. 603 + 3 pages.

See also: **9920** (pure oleic acid); **10939** ("skin" for boundary layer stabilization).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

10182 Control System Analysis and Design Via the "Second Method" of Lyapunov. II. Discrete-Time Systems. The second method of Lyapunov is applied to the study of discrete-time (sampled-data) systems. With minor variations, the discussion parallels that of the companion paper on continuous-time systems. ***R. E. Kalman and J. E. Bertram.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 394-400.

10183* Linear Electrical Model of a Gas Pipeline. Shows that by replacing an object with distributed parameters, such as a pipeline, by an RC-chain of 16 links with concentrated parameters gives a divergence of less than 5% for times exceeding 0.1% of the time of the transitional process. (*In Ukrainian.*) Liniĭna elektrichna model' gazoprovodu. ***M. A. Zhidkova.*** *Akademīia Nauk Ukraïns'koï RSR, Dopovidi*, 1960, no. 3, p. 327-334.

10184* Design of Continuous Linear Control Systems for Minimum Probabilistic Error. To solve problems of a complexity common in control-engineering practice it is necessary to utilize major digital computers, and the paper presents all the necessary equations in an organized form for the programming of the computers. ***J. Zaborszky and J. W. Diesel.*** *Applications and Industry*, 1960, no. 48, May, p. 44-54.

10185* Design of Sampled-Data Control Systems for Minimum Probabilistic Error. Two ways are explored in this paper to measure the performance of sampled data control systems by their probabilistic error: the S-plane approach and the time-domain approach. ***J. Zaborszky and J. W. Diesel.*** *Applications and Industry*, 1960, no. 48, May, p. 54-62.

10186* Design for Minimum Probabilistic Error of Continuous Linear Control Systems Subject to Constraints. A design process is introduced to obtain the impulse response function of the continuous time-invariant linear system which has the smallest average square error for such times when its output is used, while maintaining a limited output acceleration. ***J. Zaborszky and J. W. Diesel.*** *Applications and Industry*, 1960, no. 48, May, p. 63-66.

10187* Investigation of the Feasibility of Designing Homing Aircraft Flight Control Systems for Minimum Probabilistic Error. The probabilistic error extends the generality of conventional measures of performance because it summarizes the performance of a system over its entire operating environment. ***J. Zaborszky and John W. Diesel.*** *Applications and Industry*, 1960, no. 48, May, p. 66-70.

10188* Rapid Determination of Approximate Closed-Loop Poles of Feedback Control Systems. Suggests an extension of an already existing graphical method. The technique followed requires an asymptotic gain-frequency plot of the given open-loop transfer function. ***S. K. Basu.*** *Applications and Industry*, 1960, no. 48, May, p. 96-99.

10189* Analytical Design of Controllers. II. There is treated the solution of the problem of analytical design of controllers in accordance with the given optimizing functional. The solution is found for closed area including the boundary of deflection of regulating part. (*In Russian.*) Analiticheskoe konstruirovanie reguliatorov. II. ***A. M. Letov.*** *Avtomatika i Telemekhanika*, v. 21, no. 5, May 1960, p. 561-568.

10190* Effect of Random Noises on Steady State in Step Extremum System With Parabolic Characteristic of Object. Optimum parameters of regulating part of the extremum system are calculated. The parameters must be determined by estimating deflections of characteristic from minimum in steady state. It is shown that in the particular case of uniform distribution of noise increase it is most profitable to work with low values of step. (*In Russian.*) Vliianie sluchaĭnykh pomekh na ustanovivshīĭsia rezhim raboty ekstremal'noĭ sistemy shagovogo tipa pri parabolicheskoĭ kharakteristike ob'ekta. ***T. I. Tovstukha.*** *Avtomatika i Telemekhanika*, v. 21, no. 5, May 1960, p. 575-584.

10191* Effect of Random Processes on Sampled-Data Systems. There are considered problems of statistical calculation of sampled-data systems effected by stationary random processes. A particular case of effect of non-stationary random process is analyzed as well. It is shown that the method of statistical linearizing can be used to approximately calculate non-linear system as it is used for calculation of continuous non-linear systems. (*In Russian.*) Vozdeistvie sluchainykh protsessov na sistemy preryvistogo regulirovaniia. ***G. I. Pyatnitsky.*** *Avtomatika i Telemekhanika*, v. 21, no. 5, May 1960, p. 585-594.

10192* Error Accumulation in Calculation on Digital Computers. There is described a statistical method of error estimate of computing devices used in automatic control systems and of specialized and general-purpose computers. The method is based on the theory of random diffusion. Errors of such computing processes are analyzed in which sequential simple errors can be considered as independent random values distribution densities of which approach normal. (*In Russian.*) Nakoplenie oshibok pri vychisleniikh na tsifrovykh ustroĭstvakh. ***V. A. Brick.*** *Avtomatika i Telemekhanika*, v. 21, no. 5, May 1960, p. 595-600.

10193* Effect of Rate Feedback on Dynamics of Relay Servosystem With Load. There is analysed effect of the rate feedback on free oscillations of the relay servosystem with load. The linear part of the servosystem is described by the complete second-order equation. Accurate methods and the theory of point transformation are used for the analysis. (*In Russian.*) Vliianie skorostnoĭ sviazi na dinamiku releĭnogo servomekhanizma, nakhodiashchegosia pod nagruzkoĭ. ***N. S. Gorskaya.*** *Avtomatika i Telemekhanika*, v. 21, no. 5, May 1960, p. 601-614.

10194* On Simulation of Linear System With *n* Stationary Random Inputs Without Generators of Random Disturbances. There is described a method of determination of mean square of output valve of the linear system with *n* stationary random inputs by means of an analog computer without generators of random processes. The method is a generalization of the method treated in [2] for systems with *n* inputs. (*In Russian.*) O modelirovanii lineĭnoĭ sistemy s n statsionarnymi sluchaĭnymi bkhodnymi protsessami bez primeneniia generatorov sluchaĭnykh vozdeĭstviĭ. ***Ya. Shilkhanek.*** *Avtomatika i Telemekhanika*, v. 21, no. 5, May 1960, p. 652-654.

10195 Automation of Computer Panel Wiring. The program initially minimizes over-all wire length on a panel while taking into account the following restrictions: maximum allowable number of connections to a pin; routing wires in channels to preserve wire length; accepting wire connections preassigned by the engineer. ***G. W. Altman, L. A. DeCampo, and C. R. Warburton.*** *Communication and Electronics*, 1960, no. 48, May, p. 118-125.

10196* Women's Role in Data Processing. Women have proved, at least in the field of electronic data processing that, given the opportunity, they can compete successfully with men. ***Geraldine M. Oxley.*** *Data Processing*, v. 2, Apr.-May 1960, p. 19-21.

10197* The Scope of Data Processing. Speed, cost, retailers, communications, problems in data processing, preparing for a computer system, scientific management, accessory equipment, the input problem are discussed. *Data Processing*, v. 2, Apr.-May 1960, p. 31-38.

10198 Built-in Test System for Automatic Fault Detection. Design Approach to Checkout of Complex Systems. The design was to provide a simple and reliable system of rapid faulty location capability capable of detecting a minimum of 90% of those faults that would seriously impair system operation. ***Donald H. Breslow.*** *Electronics*, v. 33, no. 25, June 17, 1960, p. 60-63.

10199 Photoelectric Control Using Cold Cathode Amplifiers. Merits of photoconductive cells and photoemissive vacuum tubes are discussed and contrasted. Two control circuits use both tyeps of light sensing elements. ***P. Bergweger.*** *Electronics*, v. 33, no. 27, July 1, 1960, p. 46-47.

10200 Using Off-Balance Bridges for Measurement and Control. Analysis of off-balance capacitance bridges provides basic design equations. Example shows design of bridge that measures capacitances ranging from 10 to 100 picofarads. ***George Revesz.*** *Electronics*, v. 33, no. 27, July 1, 1960, p. 52-54.

10201* Determination of Variations of Frequency With an Error of Digital Period Length Measurement of a Beat Frequency. A method is described with which a beat frequency of 1 c/s (10^{-6}) is generated between two frequencies to be inter-compared (1 mc/s, for instance) and the period length of the beat frequency is measured with a digital time meter having an error of 10^{-5}, for instance. A simple mixer for generating the beat frequency and a measurement example are described. (*In German.*) Bestimmung von Frequenzschwankungen mit einer Unsicherheit von 10^{-5} bis 10^{-13} durch digitale Periodendauer-Messung einer Schwebung. ***R. Mitterer.*** *Frequenz*, v. 14, May 1960, p. 157-162.

10202 High Density Digital Magnetic Recording Techniques. A comprehensive, yet general readback simulation program is described which will automatically, for any characteristic pulse, simulate all possible readback signal patterns and test them for specified reading logic as a function of bit density. ***A. S. Hoagland and G. C. Bacon.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 2-11. (TK1 In6.6e Vis.)

10203 The Optimal Organization of Serial Memory Transfers. Concerns the optimal compilation of programs whose function is to transfer words of information from one location in a serial memory to another. The procedure described for optimizing serial transfers is readily programmable for computer execution. ***Arthur Gill.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 12-15. (TK1 In6.6e Vis.)

10204 The Design of Diode-Transistor NOR Circuits. Considerations leading to the adopton of diode-transistor NOR circuitry for a moderately fast data-processing system are outlined. Development of a unique set of compatible logic packages from the basic circuit is described. ***Dale P. Masher.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 15-24. (TK1 In6.6e Vis.)

10205 Esaki Diode High-Speed Logical Circuits. Logical circuits using Esaki diodes, and which are based on a principle similar to parametron (subharmonic oscillator element) circuits, are described. Two diodes are used in series to form a basic element called a twin. ***E. Goto, et al.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 25-29. (TK1 In6.6e Vis.)

10206 Magnetic Analogs of Relay Contact Networks for Logic. Two techniques are described for designing multiapertured magnetic structures capable of realizing any specific logic function. It is pointed out that the analog of a relay tree can be used as a standard structure suitable for realizing any Boolean function. ***D. B. Armstrong, T. H. Crowley, U. F. Gianola, and E. E. Newhall.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 30-35. (TK1 In6.6e Vis.)

10207 The Determination of Carry Propagation Length for Binary Addition For the addition of two *n*-digit binary numbers which are uniformly distributed, a simple recursive algorithm is readily derived for the exact determination of the expected maximum length of zero or nonzero carry propagation. ***George W. Reitwiesner.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 35-38. (TK1 In6.6e Vis.)

10208 Regular Expressions and State Graphs for Automata. Algorithms are presented for converting a state graph describing the behavior of an automation to a regular expression describing the behavior of the same automation and for converting a regular expression into a state graph. ***R. McNaughton and H. Yamada.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 39-47. (TK1 In6.6e Vis.)

10209 A Method for the Design of Pattern Recognition Logic. A method for reducing the necessary amount of logic is presented. It is basically a method for reducing Boolean equations in many variables which contain large numbers of redundant or "don't care" terms. ***Sam D. Stearns.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 48-53. (TK1 In6.6e Vis.)

10210 Optimization of Reference Signals for Character Recognition Systems. The role of signal structure in a signal discrimination system is discussed. The optimality criterion for reference signals for detection in the case of white Gaussian independent noise is defined. ***I. Flores and L. Grey.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 54-61. (TK1 In6.6e Vis.)

10211 Frequency-to-Period-to-Analog Computer for Flow-rate Measurement. The Frequency-to-Period-to-Analog Computer is a special purpose nonlinear analog computer which accepts an a.c. voltage of varying frequency, acts upon the

period of each cycle, computes the inverse of the time period, $e = 1/T$, and holds the information for the period of the next cycle. ***Ted W. Berwin.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 62-71. (TK1 In6.6e Vis.)

10212 Soviet Computer Technology—1959. Presents a factual account of the trip of the 1959 U. S. technical delegation in computers to the Soviet Union. It includes the itinerary, descriptions of specific Soviet computers, descriptions of certain computing centers, a discussion of Soviet computer-oriented education, and a description of current circuit and component development. ***Willis H. Ware, editor.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 1, Mar. 1960, p. 72-120. (TK1 In6.6e Vis.)

10213 Optimum System Theory Using a General Bayes Criterion. An extension of the general method of obtaining an optimum system is given to include the case of nonlinear dependence of the observed function on signal parameters. ***V. S. Pugachev.*** *IRE Transactions on Information Theory*, v. IT-6, no. 1, Mar. 1960, p. 4-7. (TK1 In6.6it Vis.)

10214 Quantizing for Minimum Distortion. Discusses the problem of the minimization of the distortion of a signal by a quantizer when the number of output levels of the quantizer is fixed. The distortion is defined as the expected value of some function of the error between the input and the output of the quantizer. ***Joel Max.*** *IRE Transactions on Information Theory*, v. IT-6, no. 1, Mar. 1960, p. 7-12. (TK1 In6.6it Vis.)

10215 A Note on *P*-nary Adjacent-Error-Correcting Codes. Considers the generalization of Abramson's codes to the p-nary case, where a symbol alphabet consisting of the digits 0,1, $\cdots$, $p-1$ is used for transmission, p being a prime number. Examples of such p-nary codes are given, as well as necessary conditions for their existence. ***Bernard Elspas.*** *IRE Transactions on Information Theory*, v. IT-6, no. 1, Mar. 1960, p. 13-15. (TK1 In6.6it Vis.)

10216 Codes for the Correction of "Clustered" Errors. A method is described which permits the systematic construction of codes capable of error-free transmission, provided errors occur in "clusters" of limited duration. The method is valid for error clusters of any prescribed duration. ***Siegfried H. Reiger.*** *IRE Transactions on Information Theory*, v. IT-6, no. 1, Mar. 1960, p. 16-21. (TK1 In6.6it Vis.)

10217 A Class of Codes for Signaling on a Noisy Continuous Channel. Block codes are described, in which the code words can be computed from a much smaller set of generators. It is shown that codes of this type exist which will yield arbitrarily small error rates at any signaling rate below channel capacity. ***John L. Kelly, Jr.*** *IRE Transactions on Information Theory*, v. IT-6, no. 1, Mar. 1960, p. 22-24. (TK1 In6.6it Vis.)

10218 A Bibliography of Information Theory (Communication Theory—Cybernetics). The information includes: general theory, bandwidth and transmission capacity, definition, entropy, correlation, filtering, prediction, detection, speech, other biological applications, television, miscellaneous applications, mathematics, coding and decoding. ***F. Louis H. M. Stumpers.*** *IRE Transactions on Information Theory*, v. IT-6, no. 1, Mar. 1960, p. 25-51. (TK1 In6.6it Vis.)

10219 Static-Control Shift Registers. Two basic types of circuits using logic-function devices for reliable control of sequential, random, or evenly spaced machine and processing operations are discussed. ***E. L. Rudisill.*** *Machine Design*, v. 32, June 23, 1960, p. 140-149.

10220* Negative Numbers in Digital Computer Arithmetic. Describes two systems of negative decimal number representation for digital computer applications: the ten's-complement form, most useful in serial computers, and the nine's-complement form for use in parallel computers. ***Roy G. Saltman.*** *Sperry Engineering Review*, v. 13, no. 2, June 1960, p. 10-18.

ELECTRICAL ENGINEERING

10221* An Analytical Method of Determining Pole Locations of Certain Types of Feedback Amplifiers. The analysis is shown to be good for high- or low-frequency investigations where the system bandwidth is broad enough to prevent high- and low-frequency response interference. ***Rodger L. Gamblin.*** *Applications and Industry*, 1960, no. 48, May, p. 41-44.

10222* Transient Decay of Current Through Paralleled Mercury-Arc and Silicon Rectifiers. The program described has proved capable of predicting the current that a silicon rectifier must handle when operating in parallel with mercury-arc rectifiers during the transient phenomena associated with master trip of the a.c.-breaker to de-energize the potline. ***W. R. Hodgson.*** *Applications and Industry*, 1960, no. 48, May, p. 70-75.

10223* Series Capacitors Applied to Power Rectifiers. The series capacitor offers a workable method of decreasing the voltage regulation of single-phase diametric rectifiers supplying inductive loads. ***L. J. Hibbard and T. J. Bliss.*** *Applications and Industry*, 1960, no. 48, May, p. 75-84.

10224* Determination of Ground-Fault Current on Common A-C Grounded-Neutral Systems in Standard Steel or Aluminum Conduit. The choking effect induced into a ground-faulted line cable by a magnetic conduit enclosure should be considered in the design of long grounded-neutral circuits. ***J. A. Gienger, O. C. Davidson, and R. W. Brendel.*** *Applications and Industry*, 1960, no. 48, May, p. 84-90.

10225 Miniaturized Power Transformers. Power transformers have been reduced in size and weight through improved design techniques and materials development. ***L. W. Kirkwood.*** *Bell Laboratories Record*, v. 38, June 1960, p. 224-225.

10226* The Employment of Electronic Computers for the Solution of Problems Associated With the Generation and Distribution of Electricity. Description and structure of power systems. Methodical rules for mathematical analysis. The employment of three different mathematical machines: a.c. network analyser, analogue and digital computer. ***W. Frey.*** *Brown Bovert Review*, v. 47, nos. 5-6, May-June 1960, p. 284-291.

10227* Auto-Transformers for 400/220 kV. Describes the design of the first 400-kV auto-transformers for mid-European e.h.v. systems. Following a brief reference to some of the fundamental problems and with the aid of illustrations to transformers already completed, the author explains the development which resulted in the design of these transformers after the introduction of solid earthing. ***A. Edlinger.*** *Brown Boveri Review*, v. 47, nos. 5-6, May-June 1960, p. 292-305.

10228* A New Design of Voltage Transformer for Extremely High Voltages. Fundamental problems concerning the construction of e.h.v. voltage transformers. Insulation problems, especially with paper insulation in oil. Cascade voltage transformer: design aspects, tests to confirm insulation strength and measuring accuracy. ***H. Hartmann and B. Gänger.*** *Brown Boveri Review*, v. 47, nos. 5-6, May-June 1960, p. 306-320.

10229* Calculation of Short-Circuit Stresses in Transformer Windings With the Aid of Digital Computers. The problem is discussed in detail. A differential equation for the magnetic field, calculation of the axial forces are cited. A program for a digital computer and applications are discussed. ***M. Christoffel and A. Kuster.*** *Brown Boveri Review*, v. 47, nos. 5-6, May-June 1960, p. 321-328.

10230* The Short-Line Fault in High-Voltage Systems. Features of short-line faults, effect of breaker and breaking capacity, arc, residual conductivity of the break, fitting resistor parallel to breaker, breakers with multiple interruption, tests in h.v. systems are discussed. ***P. Baltensperger and E. Ruoss.*** *Brown Boveri Review*, v. 47, nos. 5-6, May-June 1960, p. 329-339.

10231* Airblast Circuit-Breakers for Extremely Heavy Duty. Demands on modern circuit-breakers and the heavy loads, which are handled by airblast circuit-breakers, are discussed. ***R. Petitpierre.*** *Brown Boveri Review*, v. 47, nos. 5-6, May-June 1960, p. 339-344.

10232* Aircraft Electrical Engineering. The basic requirements of aircraft electrical engineering are low weight and high reliability. Weight is kept down by high loading of components. Reliability can be improved by the adoption of static components, particularly the semiconductor. ***D. C. Flack.*** *Institution of Electrical Engineers, Journal*, v. 6, no. 65, May 1960, p. 272-277.

10233* The Input Impedance of Rectifier Modulators. It is shown how the input impedance of a rectifier modulator of series, shunt or ring type can be calculated, and a large number of cases are tabulated. ***D. G. Tucker.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. B, no. 33, May 1960, p. 273-284.

10234* The Corona Discharge and Its Application to Voltage Stabilization. The properties of a gas discharge which make it suitable for voltage stabilization are discussed. Various types of corona discharge are described, and it is shown that a corona discharge between a wire anode mounted axially in a cylindrical cathode is the most suitable for voltage stabilization. ***E. Cohen and R. O. Jenkins.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. B, no. 33, May 1960, p. 285-294.

10235 Surface Impedance of a Superconductor in a Magnetic Field. Explicit expressions for the static magnetic field variation of the surface impedance in a superconductor are derived. Detailed consideration is given to the two limiting cases of the classical skin effect and of the extreme anomalous skin effect, with the static field either parallel or perpendicular to the rf current. ***G. Dresselhaus and M. Spiewak Dresselhaus.*** *Physical Review,* v. 118, 2nd ser., no. 1, Apr. 1, 1960, p. 77-91.

10236* Analysis of Series Generator Series Motor Drive. A drive is analyzed consisting of a series-field generator, driven at a constant speed and electrically connected to a series-field motor which provides the load. ***R. W. Jones and A. U. Meyer.*** *Power Apparatus and Systems,* 1960, no. 47, Apr., p. 31-39.

See also: **10174** (properties of magnet wire insulation); **10175** (wire coatings in transformer oil); **10638** (thermoelectric power of dilute Cu alloys).

ELECTROCHEMISTRY

10237 Chromic Acid Anodizing Characteristics of Wrought Aluminum Alloys. Experimental preparation of chromic acid anodized coatings was carried out with a series of aluminum alloys. Operating variables of voltage, time, bath pH, and temperature were explored above and below the chosen standard of 40 v, 30 min, pH 0.5, and 95 F. ***George E. Best, J. G. Hecker, Jr., John W. McGrew, and R. V. VandenBerg.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 277-288, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10238 Solubilities of Titanium Tetrachloride in Mixtures of Potassium Chloride and Sodium Chloride, and the Electrode Potentials of the Titanium Chlorides in 1/1 (Mole) KCl-NaCl Solutions. It was found that titanium tetrachloride vapor reacted with potassium chloride to form the compound K_2TiCl_6. Some of the physical properties of this compound, and the rates of its formation between 280 and 720 C, were investigated. Using a silver-silver chloride reference electrode developed in a previous investigation, the apparent standard electrode potential of the of the system Ti, $TiCl_3(_{KCl} + _{NaCl})$, and the apparent standard redox potentials of the systems $TiCl_3$, $TiCl_3(_{KCl} + _{NaCl})$ and $TiCl_3, K_2TiCl_6(_{KCl} + _{NaCl})$ were measured at 670 C, and found to be, respectively, 1.115, 0.910, and -0.350 volts. ***S. N. Flengas.*** *Canada, Mines Branch, Research Report,* R-50, Jan. 1960, 20 pp. (TN26 C16.5r Contin.)

10239* Chromium Plating on Titanium Alloys. No completely satisfactory method for electrodeposition of Cr on Ti and its alloys is currently available. As with steels, different types of pretreatment are necessary for electrodeposition of adherent Cr on various Ti alloys. ***Charles Levy.*** *Metal Finishing,* v. 58, May 1960, p. 49-55.

10240* Analysis of Cyanide Zinc Baths. The method outlined gives sharp endpoints and the time involved for both cyanide and Zn determination is considerably shorter than with other methods. ***Andrejs Salka.*** *Metal Finishing,* v. 58, May 1960, p. 59-60.

10241* The Preparation and Properties of Iron-Nickel Films. A chloride bath is described for the preparation of Fe-rich films by electrodeposition. These films are isotropic, as indicated by measurements of 60-cycle B-H loops. This behavior is similar to that of the Ni-rich films described in the literature. The addition of thiourea to the chloride bath causes extreme changes in the composition and physical properties of the plated films. ***Ignatius Tsu.*** *Plating,* v. 47, June 1960, p. 632-633.

10242* Determination of Sulfate in Chromium Plating Solutions. An evolution method for the determination of sulfate in Cr plating solutions is described. Sulfate is reduced to sulfide with hydriodic acid "reducing mixture". Liberated hydrogen sulfide is trapped in ammoniacal zinc sulfate solution. A standard potassium iodate-iodide solution is used to titrate resultant hydrogen sulfide. ***Gloria J. McKinley and Anne Quinlan Jones.*** *Plating,* v. 47, June 1960, p. 634-636.

10243* The Polarographic Analysis of Gold and Gold Alloy Plating Solutions. The metal plated is usually Ni, Cu, brass or Ag, and these ions may also be found as impurities. The most common alloying constituents in a Au solution are Ag, Ni, and Cu. ***A. E. Knotowicz and George Tatoian.*** *Plating,* v. 47, June 1960, p. 645-647.

10244* Effects of Anions and Temperature on the Speed of Electrodeposition of Cadmium, Iron, Copper and Zinc. The opposite influence of halide and O-containing anions near 45-55 C on the speed of electrolysis is explained. (*In Russian.*) Vliianie anionov i temperatury na skorost' elektroosazhdeniia kadmiia, zheleza, medi i tsinka. ***A. V. Pamfilov, V. S. Kuzub, and L. G. Kuzub.*** *Ukrainskĭ Khimicheskĭ Zhurnal,* v. 26, no. 2, 1960, p. 174-181.

10245* Investigation of the PbO-SiO_2 System by the Method of the Electromotive Forces. Performed at 940 C in the entire interval of concentrations where the system studied is homogeneous, the investigation revealed sudden changes of the electromotive forces for melts corresponding to the following formulas $4PbO \cdot SiO_2$, $2PbO \cdot SiO_2$, $PbO \cdot SiO_2$, and $2PbO \cdot 3SiO_2$ and indicating the existence of four types of ion complexes in these melts. (*In Russian.*) Issledovanie sistemy PbO–SiO_2 metodom elektrodvizhushchikh sil. ***V. I. Minenko, S. M. Petrov, and L. F. Kirilenko.*** *Ukrainskĭ Khimicheskĭ Zhurnal,* v. 26, no. 2, 1960, p. 195-197.

10246 High-Purity Chromium by Electrolysis. High-purity chromium was prepared in massive form by the electrolysis of chromium trioxide solution at high temperatures. The metal thus obtained, containing 50 to 150 p.p.m. of O, 20 p.p.m. of N, and traces of metallic impurities, could be hot-worked to rod and sheet and drawn to wire ductile at room temperatures. ***P. C. Good, D. H. Yee, and F. E. Block.*** *U. S. Bureau of Mines Report of Investigations* 5589, Apr. 1959, 17 pp. (TN21 Un3r Vis.)

10247* The Influence of Urea on the Electrolytic Deposition of Nickel. Urea has a highly detrimental effect on the current yield of a Ni bath as the yield is reduced to less than 50%. The presence of urea gives rise to higher polarizations which can be only partially reduced by increasing the temperature and current density. With a urea addition, however, it is possible at low p_H values of the bath, to obtain good Ni deposits even with comparatively low Ni salt concentrations and even with high current densities of 20 amps/dm^2. The brightness of the Ni coating is considerably improved by urea. (*In German.*) Über den Einfluss von Harnstoff auf die elektrolytische Nickelabscheidung. ***W. Machu and M. F. M. El-Ghandour.*** *Werkstoffe und Korrosion,* v. 11, no. 5, May 1960, p. 283-286.

10248* Investigations of the Constitution of Copper Electrolysis Mud. Investigations revealed the presence of Ag as Ag_2Se, CuAgSe, Ag_2Te, (Ag, Au)Te_2 or AgCl. Cu exists in the form of CuAgSe, in micaceous Cu, in Cu_2S, $CuSO_4$ and Cu_2Cl_2. Pb appears as $PbSO_4$ and in the form of several antimonates, especially as $PbSb_2O_6$ and as arsenates. Sn is represented by SnO_2. $NiSO_4$ and NiO were found also. (*In German.*) Untersuchungen über die Konstitution von Kupferelektrolyseschlämmen. ***U. Hennig and F. Pawlek.*** *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 13, May 1960, p. 205-212.

10249* The Effect of Self-Adjustment on Polarization Measurements During the Electrodeposition of Metals. It has been shown by the electrodeposition of zinc that in the process of electrolysis with increasing current density the growing part of the surface increases so that the true current density remains constant (the law of self-adjustment). It has been found that the greater the rate of electrode passivation during the electrodeposition by the adsorption of surface active substances the faster the self-adjustment of the growing surface. (*In Russian.*) O roli samoprisposobleniia v poliarizatsionnykh izmereniiakh pri elektroosazhdenii metallov. ***Z. A. Solov'eva and A. T. Vagramian.*** *Zhurnal Fizicheskoĭ Khimii*, v. 34, no. 4, Apr. 1960, p. 754-758.

See also: **10541** (corrosion resistance of Cr plate); **10555** (embrittlement of steel during electroplating).

ELECTRONICS

10250 Amplifying With Atoms. In future long-range systems, including schemes like TV signals bounced from orbiting satellites, engineers may combat noise by amplifying with atoms. ***M. Brotherton.*** *Bell Laboratories Record*, v. 38, May 1960, p. 163-167.

10251 Some Recent Improvements in Low Pulse Generators. Three low power pulse generators used as submodulators driving a 5C22 type of thyratron are described. These may be triggered by an external sine wave or pulse source, or may free-run with a high degree of temperature stability. All circuits use miniature thyratrons. ***R. P. F. Lauder and P. A. James.*** *British Institution of Radio Engineers, Journal*, v. 20, Apr. 1960, p. 253-263.

10252 The Application of Printed Wiring to Development and Small Batch Production With Particular Reference to Television Equipment. Better utilization of engineering staff and a reduction of development time can be achieved by a new grade of labor which serves as a link between development engineers and the drawing office. These "translators" convert circuit diagrams and associated component schedules into wiring and component legend layouts for printed wiring boards. ***E. Davies.*** *British Institution of Radio Engineers, Journal*, v. 20, Apr. 1960, p. 265-279.

10253 The Plated Circuit in the Large-Scale Production of Television Receivers. The etched foil and plated techniques of producing printed wiring are compared. A detailed description is given of the plated circuit method. The advantages of the plated circuit are: greater reliability due to improved soldered connections to components, absence of curvature of the board, and ease of replacements of components. ***W. I. Flack.*** *British Institution of Radio Engineers, Journal*, v. 20, Apr. 1960, p. 283-289.

10254 Some New Possibilities in Civil Underwater Echo-Ranging. Describes eight projects currently in hand in the Electrical Engineering Department of the University of Birmingham, which are: electronic sector scanning, multiplicative reception, wideband echo-ranging, interferometric echo-sounder, "bottom-lock" frequency-modulated echo-sounder, continuous-wave echo systems, transfer of oscilloscope display to paper chart, and automatic electronic beam stabilization. ***D. G. Tucker.*** *British Institution of Radio Engineers, Journal*, v. 20, Apr. 1960, p. 299-311.

10255 Tubes or Transistors: A Realistic Assessment. There is ample evidence that transistors are far from displacing tubes generally, and there is still much work to be done in the field of transistors. ***R. E. Moe.*** *Communication and Electronics*, 1960, no. 48, May, p. 81-85.

10256 The Empretron, a Mercury Pool Arc Tube Allowing Operation at Repetition Rates in the Kilocycle Range. The Empretron is a new mercury pool arc tube for switching applications. The arc between the mercury pool cathode and the main anode is initiated by a vacuum spark. The main use of this device is in pulse modulator service. ***K. G. Hernqvist and F. H. Norman.*** *Communication and Electronics*, 1960, no. 48, May, p. 85-91.

10257 Recent Developments on Magnetic-Coupled Multivibrators. Results of recent investigations concerning new circuits for magnetic-coupled multivibrators and their use at high frequencies, up to about 100,000 cps (cycles per second). ***William A. Geyger.*** Communication and Electronics, 1960, no. 48, May, p. 106-112.

10258* A Passive Waveform Shaping Circuit. A simple circuit is described which is able to perform a variety of waveform shaping functions. Although no active components are used, sharp transitions in output voltage can be obtained which are delayed in time with respect to the input voltage. ***M. J. Wright.*** *Electronic Engineering*, v. 32, June 1960, p. 341-343.

10259* A Graphical Analysis of the Blocking Oscillator. II. The blocking oscillator is a very economical type of circuit for generating relatively high power pulses from small receiving type valves, but its use is sometimes restricted because of the variations in pulse shape which may occur when the valve is changed. ***D. Chambers.*** *Electronic Engineering*, v. 32, June 1960, p. 348-354.

10260* The Effects of Encapsulation on Electronic Components. A survey is made of the effects of encapsulation on commonly used components. Valves may be encapsulated safely provided that the correct techniques are used to remove self-generated heat and to protect the glass envelope. Little difficulty is encountered with transistors and capacitors. ***F. P. Campbell.*** *Electronic Engineering*, v. 32, June 1960, p. 366-371.

10261* Semiconducting Indium Compounds. The applications of InSb depend directly on two principal features: the small band gap and the high electron mobility. As a result of the small band gap, the material is capable of showing photoconduction which extends to 7·5 microns. It finds application in infra-red spectroscopy and low temperature pyrometry. *Electronic Engineering*, v. 32, June 1960, p. 373-375.

10262* The New Electronics. Problems of thermal noise, electrical conduction, and low temperatures are discussed. *Electronic Technology*, v. 37, June 1960, p. 214-216.

10263* Single-Control Element Wien Bridge. A great variety of apparatus uses the Wien bridge as the basis of design; the modified version described here has the same field of application and has the added advantage that the performance of the network is determined by one control-element only, as distinct from the two which are essential to the Wien bridge. ***E. R. Wigan.*** *Electronic Technology*, v. 37, June 1960, p. 223-231.

10264* Modern Trends in Magnetron Design. Modern developments in magnetron design are described. It would appear that the major use of the magnetron will continue to be as a compact, efficient and low-cost source of high-energy pulses. ***A. H. Pickering.*** *Electronic Technology*, v. 37, June 1960, p. 234-237.

10265* The Junction Transistor. The earthed-emitter circuit is to be considered as fundamental to junction-transistor action as otherwise many transistor circuits, including feedback amplifiers and oscillators, would not have been possible. ***M. K. Achuthan.*** *Electronic Technology*, v. 37, June 1960, p. 238-240.

10266* Low-Frequency Noise Generator. It has been shown that the arrangement here described provides a source of noise having a spectrum level to better than 1 dB from zero frequency to 60 c/s and a gaussian distribution of amplitudes. ***D. A. Bell and A. M. Rosie.*** *Electronic Technology*, v. 37, June 1960, p. 241-245.

10267 Parametron Computer Circuits. Discusses characteristics and coupling of parametrons prefaces. Logic, register, adder, counter, translator and converter circuits are described. ***Kyozo Nagamori.*** *Electronics*, v. 33, no. 23, June 3, 1960, p. 73-78.

10268 Biasing Methods for Tunnel Diodes. Describes how to determine the proper bias and the correct circuit impedances for operating the tunnel diode as a switch, amplifier or oscillator. ***Ray P. Murray.*** *Electronics*, v. 33, no. 23, June 3, 1960, p. 82-83.

10269 Antenna Design for Maximum L-F Radiation. Here are design criteria for electrically short antennas with high radiation efficiency, plus data from test antennas. ***George J. Monser and Wallace D. Sabin.*** *Electronics*, v. 33, no. 23, June 3, 1960, p. 84-86.

10270 Digital Measurement of Axis-Crossing Intervals. System may provide knowledge necessary for the design of weak signal detectors based on an axis-crossing interval principle. ***A. J. Rainal.*** *Electronics*, v. 33, no. 23, June 3, 1960, p. 88-91.

10271 Television System for Stratoscope. I. Unconventional slow-scan TV chain assists astronomers in finding sunspots with balloon-borne optical telescope. ***L. E. Flory, G. W. Gray, J. M. Morgan, and W. S. Pike.*** *Electronics*, v. 33, no. 25, June 17, 1960, p. 49-53.

10272 Broadband Log-Periodic Antennas. These antennas can operate over a 10:1 frequency bandwidth while a range of antenna configurations confer important directional characteristics. Representative types of antennas are presented in this short survey. ***Ross L. Bell.*** *Electronics*, v. 33, no. 25, June 17, 1960, p. 58-59.

10273 Solid-State Modulator Feeds Subminiature Transponder. Transponder features a semiconductor modulator whose fast switching time results in an r-f output pulse with extremely fast rise and fall times. Delay stability provides a range accuracy of one yard over a wide range of interrogation signal levels. ***Liscum Diven.*** *Electronics*, v. 33, no. 27, July 1, 1960, p. 48-51.

10274* Transistorized Data Amplifier Has High Gain-Stability. Circuit refinements and careful design give a data amplifier high gain-stability and linearity and low output impedance. ***Franklin Offner.*** *Electronics*, v. 33, no. 27, July 1, 1960, p. 55-58.

10275* The Television Allocations Study Organization—A Summary of Its Objectives, Organization and Accomplishments. Outlines the objectives and organization of the Television Allocations Study Organization (TASO), and summarizes the more significant findings relating to field strength measurement and analysis, field tests of television reception, laboratory studies of television picture quality, tropospheric wave propagation, and performance of receiving and transmitting equipment. ***George R. Town.*** *I.R.E. Proceedings*, v. 48, June 1960, p. 993-999.

10276* The Measurement of Television Field Strengths in the VHF and UHF Bands. Discusses the details of the TASO field strength measuring specification and describes the program of field strength measurements. A summary of the results of the measurements is presented. ***H. T. Head and O. L. Prestholdt.*** *I.R.E. Proceedings*, v. 48, June 1960, p. 1000-1008.

10277* Determining the Operational Patterns of Directional TV Antennas. It was found that propagation conditions did not materially affect the directivity of the array, even at distances where the scatter fields were of appreciable magnitude. In the course of these measurements and tests, a procedure was developed whereby the operational antenna pattern could not only be determined, but also rechecked at suitable intervals thereafter. ***F. G. Kear and S. W. Kershner.*** *I.R.E. Proceedings*, v. 48, June 1960, p. 1088-1097.

10278 Theory of Coupled Folded Antennas. Formulas for the mutual and self-impedance of two identical nonstaggered parallel-folded dipoles are developed. A generalization of the theory permits determination of these impedances for any identical dual configuration of wires, no matter how complicated, provided the structures are symmetrical with respect to the driving points. ***C. W. Harrison, Jr. and Ronold King.*** *IRE Transactions on Antennas and Propagation*, v. AP-8, no. 2, Mar. 1960, p. 131-135. (TK1 In6.6ap Vis.)

10279 The Slot Antenna With Coupled Dipoles. The problem of an array consisting of a slot antenna and two symmetrically-located cylindrical dipoles is formulated. The approximate distribution of the current along each antenna is obtained by a method of iteration. ***R. W. P. King and G. H. Owyang.*** *IRE Transactions on Antennas and Propagation*, v. AP-8, no. 2, Mar. 1960, p. 136-143. (TK1 In6.6ap Vis.)

10280 Radiation Patterns of Finite-Size Corner-Reflector Antennas. Radiation patterns were measured for corner-reflector antennas having various combinations of widths and lengths of the reflecting surfaces. Radiation patterns are arranged according to the size of the reflecting surfaces. ***A. C. Wilson and H. V. Cottony.*** *IRE Transactions on Antennas and Propagation*, v. AP-8, no. 2, Mar. 1960, p. 144-157. (TK1 In6.6ap Vis.)

10281 Reciprocity and Scattering by Certain Rough Surfaces. General conclusions, relating to reciprocity, power conservation, grazing behavior, etc., for rough surface scattering, are made and applied heuristically to show that grazing reflection and backscatter from the rough ocean should be independent of polarization. ***W. S. Ament.*** *IRE Transactions on Antennas and Propagation*, v. AP-8, no. 2, Mar. 1960, p. 167-174. (TK1 In6.6ap Vis.)

10282 Backscattering From a Finite Cone. Backscattering is calculated for an acoustic wave incident on a hard or soft finite cone, and for an electromagnetic wave incident on a perfectly-conducting finite cone. ***Joseph B. Keller.*** *IRE Transactions on Antennas and Propagation*, v. AP-8, no. 2, Mar. 1960, p. 175-182. (TK1 In6.6ap Vis.)

10283 Optimum Radar Integration Time. The authors have derived an expression which reveals what the optimum integration period is when the radius of the region to be protected, and the velocity of the approaching target, are known. ***J. M. Flaherty and E. Kadak.*** *IRE Transactions on Antennas and Propagation*, v. AP-8, no. 2, Mar. 1960, p. 183-185. (TK1 In6.6ap Vis.)

10284 Apparent Thermal Noise Temperatures in the Microwave Region. The necessary equations are presented for obtaining the noise temperature due to thermal radiation which would be sensed by a receiver with an antenna located at some altitude above the earth. Emission and absorption of radiation by the atmosphere is considered. ***Eric Weger.*** *IRE Transactions on Antennas and Propagation*, v. AP-8, no. 2, Mar. 1960, p. 213-217. (TK1 In6.6ap Vis.)

10285 A Comparison of Several Methods of Measuring Noise in Magnetic Recorders for Audio Applications. Discusses the various methods of measuring noise in audio magnetic recorders, and data are shown comparing the numbers observed for the different methods when applied to the same recorder. ***John G. McKnight.*** *IRE Transactions on Audio*, v. AU-8, no. 2, Mar.-Apr. 1960, p. 39-42. (TK1 In6.6au Vis.)

10286 Magnetic Recording and Reproduction of Pulses. The most widely used techniques for recording digital information on a moving magnetic medium are return-to-zero (RZ) and non-return-to-zero (NRZ). From a combination of experimental and theoretical data, the width and height of the reproduced pulse are computed for variable gap width, medium thickness, and head-to-medium spacing. ***Donald F. Eldridge.*** *IRE Transactions on Audio*, v. AU-8, no. 2, Mar.-Apr. 1960, p. 42-57. (TK1 In6.6au Vis.)

10287 High-Density Magnetic Recording. By improving the mechanical properties of magnetic recording heads and recording media, it has been possible to demonstrate consistent recordings at information densities up to 40,000 cycles per inch. No fundamental magnetic limit to the maximum recording density has been detected. ***James J. Brophy.*** *IRE Transactions on Audio*, v. AU-8, no. 2, Mar.-Apr. 1960, p. 58-61. (TK1 In6.6au Vis.)

10288 Path-Loss Measuring Techniques and Equipment. Describes the techniques and equipment used to evaluate proposed installations. The equipment operates in the frequency range of 875 to 940 or 1650 to 1950 mc with output powers of 10 or 100 watts. A logarithic recording system is used which makes possible a dynamic signal recording range of 50 to 100 db. Automatic frequency control is employed to achieve a 300-cps 3-db bandwidth with moderate oscillator stabilities. ***J. Polyzou and M. Sassler.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 9-13. (TK1 In6.6cs Vis.)

10289 High Average Power Dissipation in Helix Tubes. By precisely shrinking the glass envelope around the helix to a controlled depth, thus providing an exceptionally low thermal impedance to the outside of the envelope, and passing a suit-

able coolant over the envelope, it has been found that the power dissipation capability of helix circuits can be extended by more than one order of magnitude. ***Arthur H. Iverson.*** *IRE Transactions on Electron Devices*, v. ED-7, no. 2, Apr. 1960, p. 74-77. (TK1 In6.6ed Vis.)

10290 Targets for Storage and Camera Tubes. Several new information storage targets have been developed for use in storage tubes and camera tubes. One, a double-sided mosaic, is useful primarily in storage tubes. The others, based upon the use of thin self-supported films of magnesium oxide, can be used in many tubes. ***H. R. Day, H. J. Hannam, and P. Wargo.*** *IRE Transactions on Electron Devices*, v. ED-7, no. 2, Apr. 1960, p. 78-83. (TK1 In6.6ed Vis.)

10291 Theoretical Power Output and Bandwidth of Traveling-Wave Amplifiers. Calculations are made for helix-type tubes and it is shown how to calculate the power output of tubes using more dispersive structures in terms of calculations made for helix tubes. The principal factors accounting for higher power output of dispersive structures are presented and discussed. ***H. Sobol and J. E. Rowe.*** *IRE Transactions on Electron Devices*, v. ED-7, no. 2, Apr. 1960, p. 84-94. (TK1 In6.6ed Vis.)

10292 Contributions to the Knowledge of Excess Noise. Describes measurements on the noise behavior of a long, magnetically focused electron beam with a convergent Piece-type electron gun having a shielded cathode. It is found that the excess noise phenomenon is initiated by a scallop-beam amplification. ***H. P. Louis.*** *IRE Transactions on Electron Devices*, v. ED-7, no. 2, Apr. 1960, p. 95-99. (TK1 In6.6ed Vis.)

10293 High Performance Impedance Transformation With the EFP-60 Secondary-Emission Pentode. The unique characteristics of the EFP-60 secondary-emission pentode make it possible to utilize this tube in a novel cathode follower circuit in which the impedance transformation action is "enhanced" by connection of the secondary-emission dynode back to the cathode. ***N. S. Nahman and E. J. Martin, Jr.*** *IRE Transactions on Electron Devices*, v. ED-7, no. 2, Apr. 1960, p. 99-104. (TK1 In6.6ed Vis.)

10294 A Statistical Theory of Target Detection by Pulsed Radar. Presents data from which one may obtain the probability that a pulsed-type radar system will detect a given target at any range. This is in contrast to the usual method of obtaining radar range as a single number, which can be taken mathematically to imply that the probability of detection is zero at any range greater than this number, and certainty at any range less than this number. It is shown briefly how the results for pulsed-type systems may be applied in the case of continuous-wave systems. ***J. I. Marcum.*** *IRE Transactions on Information Theory*, v. IT-6, no. 2, Apr. 1960, p. 59-144. (TKI In6.6it Vis.)

10295 Probability of Detection for Fluctuating Targets. Considers the probability of detection of a target by a pulsed search radar, when the target has a fluctuating cross section. Formulas for detection probability are derived, and curves of detection probability vs. range are given, for four different target fluctuation models. ***P. Swerling.*** *IRE Transactions on Information Theory*, v. IT-6, no. 2, Apr. 1960, p. 269-308. (TK1 In6.6it Vis.)

10296 An Analysis of Four-Frequency Nonlinear Reactance Circuits. Several advantages of multiple-frequency nonlinear reactance circuits are described in this paper. In particular, a circuit is considered in which a nonlinear reactance couples four basic frequencies: ω_0, ω_1, ω_2, and ω_3; these are so related that $\omega_3 = \omega_0 + \omega_1$ and $\omega_3 = \omega_0 - \omega_1$. Here ω_0 is taken to be the power source or pump. ***David K. Adams.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 274-283. (TK1 In6.6mt Vis.)

10297 Some Properties of Three Coupled Waves. Deals with the problem of three waves, 1, 2, and 3, in which waves 2 and 3 are coupled to wave 1 but not to each other. The general solution for the amplitudes of the waves is given in closed form. It is shown that for certain values of the parameters growing waves can exist. ***Laszlo Solymar.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 284-291. (TK1 In6.6mt Vis.)

10298 Noise Figures of Reflex Klystron Amplifiers. The noise figure of the 2K25 reflex klystron amplifier was investigated. The noise figure of the reflex klystron amplifier depends on operating frequency, electronic impedance, circuit impedance, and operating electronic mode. Experimental results show that a noise figure of 5 db is possible under particularly carefully adjusted conditions. ***Koryu Ishii.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 291-294. (TK1 In6.6mt Vis.)

10299 On Measurements of Microwave $\overline{E}$ and $\overline{H}$ Field Distributions by Using Modulated Scattering Methods. The modulated scattering method of Justice, Rumsey, and Richmond for measuring $\overline{E}$ field distribution is extended to the measurement of $\overline{H}$ field distribution by using a loop scatterer formed by two diodes. This diode loop method has the particular advantage of eliminating the large and undesirable effect produced by the associated $\overline{E}$ field when measuring the $\overline{H}$ field. ***Ming-Kuei Hu.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 295-300. (TK1 In6.6mt Vis.)

10300 Analysis of Certain Transmission-Line Networks in the Time Domain. Many linear components in nondispersive transmission line are made up solely of commensurate lengths of line of various characteristic impedances. Such components have impulse responses that are a series of equispaced impulses, and as a result, their frequency responses can be written as a Fourier series. ***W. J. Getsinger.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 301-309. (TK1 In6.6mt Vis.)

10301 Sets of Eigenvectors for Volumes of Revolution. The electric and magnetic eigenvectors of a volume of revolution can be written in terms of two-dimensioal scalar and vector functions. These functions are the eigenfunctions of certain linear transformations in the meridian plane. ***J. Van Bladel.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 309-319. (TK1 In6.6mt Vis.)

10302 A Printed Circuit Balun for Use With Spiral Antennas. A novel printed circuit balun is described which is particularly well suited to applications where space is at a premium. The design utilizes unshielded strip transmission line, but is readily adaptable to all of the common printed circuit transmission line techniques. ***R. Bawer and J. J. Wolfe.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 319-325. (TK1 In6.6mt Vis.)

10303 The *P-I-N* Modulator, an Electrically Controlled Attenuator for MM and Sub-MM Waves. The construction and performance of a millimeter wave modulator are described. The main part of the modulator consists of a *p-i-n* germanium structure inserted into a rectangular waveguide. ***F. C. De Ronde, H. J. G. Meyer, and O. W. Memelink.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 325-327. (TK1 In6.6mt Vis.)

10304 Discontinuities in the Center Conductor of Symmetric Strip Transmission Line. A systematic measurements program has been carried out to check the validity of theoretical formulas for the equivalent circuit parameters of a variety of discontinuities in the center conductor of symmetric strip transmission line. ***H. M. Altschuler and A. A. Oliner.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 328-339. (TK1 In6.6mt Vis.)

10305 A Variational Integral for Propagation Constant of Lossy Transmission Lines. By assuming that the current on a lossy transmission line flows in the axial direction, only a variational integral for the propagation constant can be readily obtained. This variational integral shows that the usual power loss method of evaluating the attenuation constant is valid for general transmission lines. ***Robert E. Collin.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 339-342. (TK1 In6.6mt Vis.)

10306 Measurement of Bandwidth of Microwave Resonator by Phase Shift of Signal Modulation. Bandwidth is measured by transmission of a signal with sine-wave modulation through a microwave resonator under test. The modulation frequency is adjusted so that the envelope is delayed 45° with

respect to the input, indicating that the two sideband frequencies are separated by the half-power bandwidth. ***D. S. Lerner and H. A. Wheeler.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 343-345. (TK1 In6.6mt Vis.)

10307 A Y-Junction Strip-Line Circulator. The theoretical approach to the three-port symmetrical circulator is reviewed and presented in a form valid for the most general waveguide case. A strip-line Y-junction circulator is described and the performance of different units in the band 800-1600 mc is illustrated. ***U. Milano, J. H. Saunders, and L. Davis, Jr.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 346-351. (TK1 In6.6mt Vis.)

10308 A Wide-Band UHF Traveling-Wave Variable Reactance Amplifier. The techniques developed for designing periodically loaded traveling-wave parametric amplifiers using variable-reactance diodes are described in detail. An amplifier was built and tested with two different sets of eight diodes. ***R. C. Honey and E. M. T. Jones.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 351-361. (TK1 In6.6mt Vis.)

10309 On the Theory of Strongly Coupled Cavity Chains. A chain of identical cavity resonators coupled together through slots in their common walls forms a band-pass microwave filter. The pass band characteristics of such a system are determined by a combination of field theory and circuit theory. The fields in the cavities are expressed in terms of the normal modes of the uncoupled cavities. ***M. A. Allen and G. S. Kino.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 362-372. (TK1 In6.6mt Vis.)

10310 Calculation of Average Failure-To-Failure Time of Equipment. Gives a number of asymptotic expressions for the laws of probability distribution of the operation time of equipment until the first failure. Deals with the methods of approximate calculation of the law of change of the average failure-to-failure operation time of equipment, from any optionally chosen instant of time t_k. ***M. A. Sinitsa.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 1-5. (TK1 In6.6q Vis.)

10311 On Reservation by Replacement Method. A method of design of a reliable system, consisting of many operating and spare components, for the case of statistical relation between failures of operating and spare components is considered. Effective usage of a single spare component substituted for several operating components is considered. ***M. A. Sinitsa.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 6-13. (TK1 In6.6q Vis.)

10312 Some Results of Mathematical Reliability Theory. The mathematical reliability theory provides, for the engineer, the possibility of finding a rational method to predict reliability of the system by statistical analysis of experimental component reliability data. Some results of the mathematical reliability theory obtained are described. ***B. R. Levin.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 14-18. (TK1 In6.6q Vis.)

10313 Purchasing Reliability. Procurement departments must, in the future, make full use of measurement and control techniques to assure that their selection of vendors has assisted the over-all reliability program. The described control system has demonstrated several advantages. ***E. J. Breiding.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 19-22. (TK1 In6.6q Vis.)

10314 Diagnosis of Equipment Failures. Introduces several new concepts which are applicable to the problem of diagnosis of equipment failures. ***J. D. Brulé, R. A. Johnson, and E. J. Kletsky.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 23-34. (TK1 In6.6q Vis.)

10315 Reliability of Parallel Electronic Components. Equations are derived which permit a determination of the increase or decrease of reliability when components are connected in parallel. ***H. Walter Price.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 35-39. (TK1 In6.6q Vis.)

10316 Evaluation and Prediction of Circuit Performance by Statistical Techniques. Describes a method for predicting circuit performance to the extent that it is dependent on part performance. The basis for the prediction is the performance of parts as measured at test points fixed by the part specifications. ***J. Marini and R. Williams.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 40-52. (TK1 In6.6q Vis.)

10317 Reliability Using Redundancy Concepts. Introduces a new method of using redundancy to obtain reliable operation of electronic circuits. Switching circuits are used as examples to illustrate the method. ***L. Depian and N. T. Grisamore.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 53-60. (TK1 In6.6q Vis.)

10318 Criteria for Determining Optimum Redundancy. Redundant circuits whose components may suffer either an open-circuit or a short-circuit type of failure are considered. A probabilistic model for such circuits is proposed. ***R. E. Barlow and L. C. Hunter.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 73-77. (TK1 In6.6q Vis.)

10319 Interval Estimation of Product Reliability by Use of the Noncentral t Distribution. Describes methods used to obtain interval estimates for the statistic $t = \frac{U - \overline{x}}{s}$ obtained from a normal distribution and, thus, are applicable to any variable which is normally distributed. ***R. E. Schafer.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 77-81. (TK1 In6.6q Vis.)

10320 Reliability Predictions—A Case History. Illustrates that for large systems we are able to predict, with a fair degree of accuracy, those statistics required to evaluate the equipment from a reliability viewpoint. ***R. A. Davis and W. Wahrhaftig.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 87-90. (TK1 In6.6q Vis.)

10321 Design Information Interchange Among Co-Contractors. Describes some techniques to facilitate intercontractor reliability data exchange, and suggests procedures to increase the utilization of such data after receipt. ***Martin Barbe.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 93-96. (TK1 In6.6q Vis.)

10322 Human Factors in the Attainment of Reliability. Attention to human factors can improve the reliability attained in the design and operation of complex equipment. ***R. S. Lincoln.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 97-103. (TK1 In6.6q Vis.)

10323 Estimation From Life Test Data. Various examples and solutions are cited. ***Benjamin Epstein.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Apr. 1960, p. 104-107. (TK1 In6.6q Vis.)

10324* A Quadrature Network for Generating Vestigial-Sideband Signals. Describes a method of generating approximately a quadrature signal from a given signal using a linear network comprising a tapped delay line. It is shown that a vestigial-sideband signal free from phase distortion can be produced by this means. ***G. G. Gouriet and G. F. Newell.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. B, no. 33, May 1960, p. 253-260.

10325* Rectifier Modulators With Frequency-Selective Terminations. Solutions are obtained for the modulation-product currents in series- and shunt-type rectifier modulators by separating out an equation for each possible modulation-product frequency. ***D. P. Howson and D. G. Tucker.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. B, no. 33, May 1960, p. 261-272.

10326* Measurement of Transistor Characteristic Frequencies in the 20-1000 Mc/s Range. Apparatus is described for the rapid determination of the cut-off frequencies, f_1 and f_α, of transistors in the 20-1000 Mc/s range. Accurate measurements at these frequencies are made possible by the application of transmission-line techniques to the method of comparing the high-frequency voltages which appear across small resistors connected to two leads of the transistor. ***J. Bickley.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. B, no. 33, May 1960, p. 301-304.

10327* Comparison of Gain, Bandwidth and Noise Figure of Variable-Reactance Amplifiers and Convertors. Formulae are derived for the gain-bandwidth products and noise figures of a variable-reactance amplifier and a convertor. It is shown that for equal gains and noise figure the convertor has a greater bandwidth than the amplifier. ***J. D. Pearson and J. E. Hallett.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. B, no. 33, May 1960, p. 305-310.

10328* A Study of Atmospheric Radio Noise Received in a Narrow Bandwidth at 11 Mc/s. Equipment is described for studying atmospheric radio noise by means of continuous-film photography and by measuring the amplitude probability distributions by a pulse-counting technique. ***C. Clarke.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. B, no. 33, May 1960, p. 311-319.

10329 Segregation and Distribution of Impurities in the Preparation of Germanium and Silicon. In connection with solid-state research and the production of circuit devices based on semiconductors, much work has been done in recent years on developing and perfecting methods of refining the substances involved and introducing controlled amounts of impurities. The article below describes two such methods (variants of the zone-melting technique) for preparing "doped" single crystals of germanium and silicon. ***J. Goorissen.*** *Philips Technical Review*, v. 21, no. 7, June 1960, p. 185-195.

10330 Low-Temperature Impurity Conduction in *n*-Type Silicon. Hall coefficients and electrical resistivities were measured down to liquid He temperatures for Si specimens containing about 10^{17} P impurities per cm^3 and about 10^{15} B impurities per cm^3. The density of minority impurities was determined during the preparation of ingots. The results are extremely sensitive to the density of minority impurities. ***K. R. Atkins, R. Donovan, and R. H. Walmsley.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 411-414.

10331 Internal Field Emission at Narrow Silicon and Germanium *p-n* Junctions. A detailed study has been made of the reverse characteristics of several Si and Ge alloyed *p-n* junctions with breakdown voltages in the range of about 0.1 0.8 volt. In these junctions the reverse current is generated almost entirely by internal field emission. In Ge, the critical voltage drops monotonically as the temperature increases whereas in Si, there is considerable structure in the curve. ***A. G. Chynoweth, W. L. Feldmann, C. A. Lee, R. A. Logan, and G. L. Pearson.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 425-434.

10332* Dynamic Circuit Theory. Dynamic circuit theory covers the theory of electromechanical transducers and systems of such transducers. It provides a simple and unified basis for the treatment of electromechanical information and energy transfer. ***H. K. Messerle.*** *Power Apparatus and Systems*, 1960, no. 47, Apr., p. 1-12.

See also: **10550** (production of Ge).

ENGINEERING ECONOMICS

10333* Changes in the Rate and Components of Household Formation. In the prediction of future household formation, it proves useful to separate movements caused by population changes from those caused by shifts in the occurrence rates of households among a given population. ***Sherman J. Maisel.*** *American Statistical Association, Journal*, v. 55, no. 290, June 1960, p. 268-283.

10334* A Statistical Investigation of the Industrialization Controversy. Whether trade of the industrial countries with the nonindustrial countries declines in an industrializing world has always been a controversial question. The present paper examines this controversy with reference to events in the postwar period. The validity of the findings is tested under alternative classifications of an industrial area and in terms of current value and deflated value figures. ***Stephen Spiegelglas.*** *American Statistical Association, Journal*, v. 55, no. 290, June 1960, p. 284-298.

10335* Getting a Grip on Costs and Payoff. Real dollar payoff with more automated installations can be extremely elusive. To be sure of financial success, no one simple formula is suitable. ***Karl H. Meyer.*** *Automation*, v. 7, July 1960, p. 46-52.

10336* Automation Today—Handling Retail Merchandise. Continual necessity in retail department store operations is that of efficiently transferring a variety of goods, arriving in random sequence, within and between receiving, checking, marking, and pre-sales storage areas. *Automation*, v. 7, July 1960, p. 54-58.

10337* The Automatic Warehouse. A new company has been formed in England to produce automatic warehouse systems. *Instrument Practice*, v. 14, June 1960, p. 641.

10338* Component Replacement Liability. Management of the sponsoring firm had planned to make a policy decision based on differences between averages of overlapping distributions. After the influence of the probability distributions was evaluated and explained, management reversed its intended policy decision. ***David Debeau, George James, and William Drozda.*** *Management Science*, v. 6, no. 3, Apr. 1960, p. 295-302.

10339* Problems in the Application of Replacement Theory. Presents and analyzes the difficulties encountered in a single, but representative, area of decision-making, namely, equipment replacement. ***Raymond R. Mayer.*** *Management Science*, v. 6, no. 3, Apr. 1960, p. 303-310.

10340* Simulation of a Simplified Job Shop. Presents results of some digital computer simulation studies of a simplified model of a job shop production process. Such factors as the average effectiveness of schedules under the impact of random variations in processing type times and the effect of changing operating policies are considered. ***C. T. Baker and B. P. Dzielinski.*** *Management Science*, v. 6, no. 3, Apr. 1960, p. 311-323.

10341* Forecasting Sales by Exponentially Weighted Moving Averages. Forecasts must be made on a routine basis for thousands of products, so that they must be made quickly, and, both in terms of computing time and information storage, cheaply; they should be responsive to changing conditions. Presents a method of forecasting sales which has these desirable characteristics. ***Peter R. Winters.*** *Management Science*, v. 6, no. 3, Apr. 1960, p. 324-342.

10342 The St. Lawrence Seaway. Its impact, by 1965, upon industry of metropolitan Chicago and Illinois waterway-associated areas. ***Joseph A. Russell, Howard G. Roepke, Jerome D. Fellmann and Alfred W. Booth.*** v. 2, 71 pp. 1959. Chicago Association of Commerce and Industry, Chicago, Ill. (HC107.I3 R91s)

10343 Sources of Refractory Raw Materials and Refractories Markets in South Central United States. South Central United States, an area including Arkansas, Kansas, Louisiana, Mississippi, Missouri, Oklahoma, and Texas, is a net exporter of refractories. Nearly one-fourth of the clay refractories produced in the United States are made in Missouri. Moreover, Missouri produces most of the higher grade clay refractories, about 62% of the high-alumina refractories, and 85% of the superduty refractories. ***Howard E. Rollman and Harvard Eng.*** *U. S. Bureau of Mines Information Circular* 7950, 1960, 54 pp. (TN21 Un3i Vis.)

See also: **9935** (manufacturing costs estimation).

FLUID MECHANICS

10344 Recent Progress in Rarefied Gasdynamics. Limits of continuum flow, kinetic theory developments, near free molecule flow, and free molecule flow are discussed. ***S. A. Schaaf.*** *ARS Journal*, v. 30, May 1960, p. 443-447.

10345* Effect of Natural Convection on Transition to Turbulence in Vertical Pipes. Above was studied in a heat transfer section. The transition is related to the distortions of the velocity profile caused by natural convection. ***George F. Scheele, Edward M. Rosen, and Thomas J. Hanratty.*** *Canadian Journal of Chemical Engineering*, v. 38, no. 3, June 1960, p. 67-73.

10346 Flow of Fluids. Covers process design for the conduits of flow and discusses how to pump liquids in process lines. ***Ernest E. Ludwig.*** *Chemical Engineering*, v. 67, June 13, 1960, p. 162-208.

10347* Considerations About Scouring. A theoretical treatment in hydraulics. ***P. Franke.*** *Current Engineering Practice*, v. 2, no. 9, Mar. 1960, p. 26-34.

10348 Deformation Strain and Flow. An Elementary Introduction to Rheology. Book is mainly of interest to the chemist. ***Markus Reiner.*** 2nd Ed. 347 pp. 1960. Interscience Publishers, Inc., New York. (QC189 R27d2)

10349 On the Hyper-Chain Approximation in the Theory of Classical Fluids. The nonlinear integral equation for the hyper-chain approximation to the radial distribution function of a classical fluid is derived, and it is shown that when linearized it is equivalent to the linearized form of Born-Green theory. ***G. S. Rushbrooke.*** *Physica*, v. 26, Apr. 1960, p. 259-265.

10350 Frequency Spectrum of Finite Amplitude Ultrasonic Waves in Liquids. The perturbation analysis of such waves in a dissipative fluid has been extended to higher orders of calculation, so that the location of the maximum of the second harmonic can be ascertained with some accuracy. ***Winfield Keck and Robert T. Beyer.*** *Physics of Fluids*, v. 3, no. 3, May-June 1960, p. 346-352.

10351 Magnetohydrodynamic Wave Propagation in the Ionosphere. Study of the damping for a gas of finite conductivity shows that different wave modes may be heavily attenuated in certain directions of propagation. ***Sheldon L. Kahalas.*** *Physics of Fluids*, v. 3, no. 3, May-June 1960, p. 372-378.

10352 Cross Stresses in the Laminar Flow of Liquids. Shows that cross-elasticity effects exist in a simple homogeneous liquid such as toluene. Instrument is described. ***M. Reiner.*** *Physics of Fluids*, v. 3, no. 3, May-June 1960, p. 427-432.

10353* Mass Flow Meters for Natural Gas Measurement. ***F. Vinton Long.*** *Pipe Line News*, v. 32, June 1960, p. 26-27.

10354 An Experimental Study of Vortex Chamber Flow. Shows that simple analysis predicts the functional variation of temperature and pressure in a vortex chamber with radius and inlet velocity. ***Jack P. Holman and George D. Moore.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Note* 59-388, Oct. 1959, 28 pp. (TL507 Un3.18t Vis.)

10355* Effect of Particle Size and Interfacial Film on the Viscosity of Disperse Systems. Survey reveals that the viscosity of disperse systems is reduced if the particle sizes are increased or if the particles are polydispersed. Apart from the electroviscous crowding and adsorption effects, there is a major contribution from the interfacial slip, which agrees with the recent theories. ***E. S. Rajagopal.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 23, nos. 5-6, Mar. 1960, p. 342-347.

FOOD TECHNOLOGY

10356* New and Improving Food Products. Convenience foods, instant foods, luxury items, methods of food preservation future developments, new legislation are discussed. ***Emil M. Mrak.*** *American Dietetic Association, Journal*, v. 36, June 1960, p. 578-580.

10357 Fats and Oils. An Outline of Their Chemistry and Technology. Among the subjects discussed are autoxidation, rancidity, fat stabilizers, cholesterol in diet, selective hydrogenation, chromatography of lipids, and sequestering agents. ***H. G. Kirschenbauer.*** 2nd Ed. 240 pp. 1960. Reinhold Publishing Corp., New York. (TP670 K63f2)

10358* Biochemical Alteration of Milk Proteins by Gamma and Ultraviolet Irradiation. ***Herman F. Kraybill, Merrill S. Read, Richard S. Harding, and Theodore E. Friedemann.*** *Food Research*, v. 25, no. 3, May-June 1960, p. 372-381.

10359* Production and Prevention of Irradiated Odor in Beef. The odor is associated with sulfhydryl or closely related compounds since cysteine and methionine could no longer be detected in the protein after irradiation and since the odor is quenched by sulfhydryl reagents. The protein was found to contain small amounts of Fe and P. ***P. A. Hedin, G. W. Kurtz, and Robert B. Koch.*** *Food Research*, v. 25, no. 3, May-June 1960, p. 382-388.

10360* Analysis of Coffee Volatiles by Gas Chromatography. More than thirty volatile components of roasted coffee which contribute to the aroma and flavor have been isolated and identified in this study. These compounds include mercaptans, aldehydes, ketones, esters, acids, and heterocyclics. ***Albert Zlatkis and Michael Sivetz.*** *Food Research*, v. 25, no. 3, May-June 1960, p. 395-398.

10361* Effect of Different Length Chill Periods With Chloretracycline and Different Holding Conditions on the Shelf Life of Dressed Fryers. Treatment with CTC gave beneficial effects after ten days of storage; however, these tests indicate that there is little benefit from CTC treatments during the first ten days of storage as determined by total bacterial count and raw odor scores. ***E. O. Essary, L. E. Dawson, and W. L. Mallmann.*** *Food Technology*, v. 14, June 1960, p. 286-289.

10362* Time-Temperature Tolerance of Frozen Foods. XXII. Relationship of Bacterial Population to Temperature. At temperatures of −10 to 20 F bacterial growth never occurred, but large numbers of bacteria always survived prolonged storage. Bacterial growth always took place at temperatures at 25 F and above. Initial development of off flavor appears to be unrelated to growth of bacteria. ***H. David Michener, P. A. Thompson, and W. C. Dietrich.*** *Food Technology*, v. 14, June 1960, p. 290-294.

10363* Effect of Extraction Rate of Flour and of Supplementation With Soya Meal on the Nutritive Value of Bread Proteins. Improvement of the nutritional value of dietary proteins by increasing the percentage of flour extraction or fortification with soya meal may be expected in diets only in which wheat products represent the predominant source of protein. ***K. Guggenheim and Naomi Friedmann.*** *Food Technology*, v. 14, June 1960, p. 298-300.

10364 Potato Processing. History of potato processing, structure and chemical composition of the potato tuber, potato varieties, effect of environmental conditions on potatoes, tuber diseases, sprout inhibition, effect of transit and storage on potatoes, the nutritive value of potatoes and the preparation of different potato products are described. ***William F. Talburt and Ora Smith.*** 475 pp. 1959. The Avi Publishing Co. Inc., Westport, Conn. (TP374.P8 T14p)

10365 Processing by Irradiation. II. Application to Food Preservation. The chemical changes induced in food by radiation treatment are considered with regard to effect on quality and on nutritive value and possible toxicity. ***F. J. Ley and J. R. Hickman.*** *Research Applied in Industry*, v. 13, May 1960, p. 193-197.

10366 Freezing, Freeze-Drying and Freeze-Concentration of Foodstuffs. Three applications of refrigeration to the processing of foodstuffs are described—freezing prior to storage as frozen foods, freeze-drying by which foodstuffs are dehydrated while in the frozen state, and freeze-concentration whereby liquids are concentrated by partial freezing followed by mechanical separation of the liquid phase. ***R. Gane.*** *Research Applied in Industry*, v. 13, June 1960, p. 207-211.

FUELS AND COMBUSTION

10367 The Use of 2,2,4,4,6,8,8-Heptamethylnonane as a Primary Diesel Fuel. Ease of preparation and combustion characteristics of heptamethylnonane indicate that it might supplement or replace 1-methylnaphthalene as the low-cetane primary reference for rating diesel fuels. ***T. W. Mears, R. M. David, and F. L. Howard.*** *ASTM Bulletin*, no. 245, Apr. 1960, p. 75-78.

10368 Cryogenic Propellant Storage for Round Trips to Mars and Venus. Shows that propellant losses can be minimized by using thermal radiation shielding and stage orientation with respect to the Sun. ***George R. Smolak and Richard H. Knoll.*** *Aero/Space Engineering*, v. 19, June 1960, p. 42-46.

10369* The Interchangeability Limits of Fuel Gases. From the demands which are made on exchangeable fuel gases and from the gas properties determining these demands, a range of 16 typical gases which cover the whole field of groups exchangeable gases is derived. A classification system of these gases (including the inerts) leads to the fixing of border values for the individual fields (calorific value, content of H and density). (*In German.*) Die Grenzen der Austauschbarkeit von Brenngasen. ***Fritz Schuster.*** *Brennstoff-Wärme-Kraft*, v. 12, June 1960, p. 284-286.

10370 Vibration Phenomena in Detonation Waves in Hydrogen-Oxygen Mixtures. A photographic investigation using a Schlieren system and rotating-drum camera. ***D. H. Edwards and T. G. Jones.*** *British Journal of Applied Physics*, v. 11, May 1960, p. 190-194.

10371 Interfacial Films Affecting the Stability of Petroleum Emulsions. Where petroleum emulsions are produced it is necessary to carry out a demulsification operation in order to obtain an oil of commercial value. Most petroleum emulsions are not readily broken by heat alone, and must be resolved by other means. ***Charles M. Blair.*** *Chemistry & Industry*, 1960, no. 20, May 14, p. 538-544.

10372* Differential Thermal Analyses of Mixtures of a Low Rank Coal and Various Inorganic Compounds. Shows that ferric oxide, ammonium sulphate and sodium hydroxide react endothermically with a low rank coal during carbonization up to 600 C. Other considerations modify these results. ***A. F. Gaines and R. G. Partington.*** *Fuel*, v. 39, no. 3, May 1960, p. 193-216.

10373* Chemical Structure and Properties of Coal. XXVI. Studies on Artificial Coalification. ***J. P. Schuhmacher, F. J. Huntjens, and D. W. van Krevelen.*** *Fuel*, v. 39, no. 3, May 1960, p. 223-234.

10374 Proper Fuel Preparation Is the Key to Efficient Fuel Oil Combustion. A major step in designing for fuel oil combustion is the evaluation of the temperature-viscosity relationship necessary for peak efficiency. Limitations of the equipment in a plant and proper preparation and utilization permits efficient use of a viscous fuel oil. ***D. S. Frank.*** *Heating, Piping & Air Conditioning*, v. 32, June 1960, p. 142-146.

10375* Link Between the Burning Speed of Some Individual Hydrocarbons at Low Pressures and Their Antiknock Properties. For all the hydrocarbons considered here, with 6 to 10 C atoms in the molecule, a qualitative analogy connected with their burning speed was observed in the Bunsen flame of a heater at a 50 mm pressure of the Hg column, with antiknock properties. The individual hydrocarbon having higher antiknock properties have higher burning properties under the combustion conditions indicated. (*In Russian.*) O sviazi mezhdu skrost'iu vygoraniia nekotorykh individual'nykh uglevodorodov pri nizkikh davleniiakh i ikh antidetonatsionnymi svoĭstvami. ***V. V. Makarenkov and G. M. Panchenkov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Neft' i Gaz*, v. 3, no. 4, 1960, p. 81-84.

10376* How Coal Can Fuel the Turbo-Charged Steam Plant. Coal is burned under pressure, and the products of combustion used to operate a gas turbine. ***John I. Yellott.*** *Power Engineering*, v. 64, June 1960, p. 68 + 3 pages.

10377* Coal Research. An address on coal chemistry. ***J. S. Shannon.*** *Royal Australian Chemical Institute, Proceedings*, v. 27, Apr. 1960, p. 164-175.

10378* Liquid Fuels and Combustion. New Results in the Theory and Practice. Mechanism of droplet combustion including the formation of free C and luminous flame radiation is described. Combustion quality in terms of smoke number and CO_2 is mentioned. Combustion intensity is discussed, and various high intensity burners are described. Later results, especially in heavy fuel droplet combustion and droplet cloud combustion, are included. (*In Norwegian.*) Flytende brennstoffer—forbrenning. Nyere resultater i teori og praksis. ***H. Goksøyr.*** *Tidsskrift for Kjemi, Bergvesen og Metallurgi*, v. 20, no. 4, 1960, p. 88-92.

10379* Determination of the Dewpoint of the Outgoing Gases Containing Sulfur Anhydride. The temperature of the dewpoint of steam gases of a CYMZ reverberatory furnace is between 140 and 220 C. This temperature depends on the air excess and the SO_2 content in the steam. The coefficient $K_{SO_3} = \overline{SO_2}$ was found equal to 0.04 - 0.05. (*In Russian.*) Opredelenie tochki rosy ukhodiashchikh gazov soderzhashchikh sernyĭ angidrid. ***V. N. Timofeev and D. P. L'vov.*** *Tsvetnye Metally*, v. 30, no. 5, May 1960, p. 38-43.

10380 Fusibility of Ash of United States Coals. Provides information for the combustion engineer engaged in pulverized-coal firing and using underfeed and spreader stokers and hand-fired small industrial and domestic stokers. ***Roy F. Abernethy and Elsie M. Cochrane.*** *U. S. Bureau of Mines Information Circular* 7923, 1960, 363 pp. (TN21 Un3i Vis.)

10381* Structure of Gaseous Detonation in Pipes. Photographic recording revealed the absence of plane front of detonation and the prevailing role of the fracture of this front in the propagation of the chemical reaction. Quantitative relationships between parameters of the detonation wave and the initial pressure of the fuel mixture and the distribution of the tangential constituent speed in the front of the detonation are given. (*In Russian.*) Struktura gazovoĭ detonatsii v trubakh. ***Iu. N. Denisov and Ia. K. Troshin.*** *Zhurnal Teknicheskoĭ Fiziki*, v. 30, no. 4, Apr. 1960, p. 450-459.

See also: **10354** (vortex chamber flow).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

10382* Paragenesis of Sedimentary and Volcanogene Rocks and Formations. Discusses some types of the above formations; types of members of sedimentary associations are separated and described and the character of order of their spatial distribution in formations is analyzed. The importance of paragenesis for the separating of sedimentary formations is shown by the example of a carbonate platform formation. (*In Russian.*) Paragenezy osadochnykh i vulkanogennykh porod i formatsii. ***N. S. Schatsky.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Geologicheskaia*, 1960, no. 5, May, p. 3-23.

10383* Geochemical Methods of Exploring for Rare Elements. Applies to exploration for concentrations of the elements—Zr, Be, Sc, La, Y, Ga, and Pb. (*In Ukrainian.*) Geokhimichni metody rozshukiv ridkykh elementiv. ***E. S. Burkser and B. F. Mitskevich.*** *Akademiia Nauk Ukrains'koĭ RSR, Dopovidi*, 1960, no. 3, p. 349-352.

10384* Motions of the Ionospheric F-Layer During Geomagnetic Bay Disturbances. During positive-going geomagnetic bay disturbances a determination of the true heights of the ionospheric F-layer reveals that this layer rises. For the sinking of the layer under the influence of gravity and diffusion the motional equations of the plasma can be solved only approximately. (*In German.*) Bewegungen der F-Schicht der Ionosphäre bei erdmagnetischen Bai-Störungen. ***Harry Kohl.*** *Archiv der Elektrischen Übertragung*, v. 14, Apr. 1960, p. 169-176.

10385* Nuclear Physical Methods in Oil Prospecting and Tapping. Application of nuclear physical methods to the search for and the tapping of natural oil deposits which has been practiced for 20 years, offers much more precise evidence to boring investigation than do other processes. (*In German.*) Kernphysikalische Methoden bei der Erdölsuche und Erdölförderung. ***Lothar Wiesner.*** *Atomwirtschaft*, v. 5, no. 5, May 1960, p. 216-218.

10386* Bibliography of South Australian Geology. Includes all literature published up to including June 1958. As well as covering geology and the directly related sciences of geochemistry, geophysics, palaeobotany, palaeontology and palynology, any articles dealing with sciences such as archaeology, geography, geomorphology and pedology, but which have a direct bearing on geology, are included. ***E. N. Teesdale-Smith.*** 240 pp. 1959. South Australian Department of Mines and Geological Survey. (ZQE345 So87.5b Ref.)

10387* Bulletin of the Amreican Association of Petroleum Geologists. This report, the fifteenth based on data gathered by the Committee on Statistics of Exploratory Drilling, is the twenty-fourth annual summary on the subject published in the Bulletin. It precedes separate reports on 31 districts in North America each under separate authors. v. 44, June 1960, p. 657-945.

10388 Uranium Geochemistry in the Rockies. How uranium was deposited in parts of Rocky Mountain area is explored. One mechanism: reduction of soluble hexavalent form to less soluble tetravalent form by decaying vegetation. ***Harold F. Walton.*** *Chemical and Engineering News*, v. 38, no. 25, June 20, 1960, p. 118-122.

10389* Seismic Analysis Helps Determine Whether to Rip Overburden . . . or Blast It. In several tests already carried out in Australia, this method has successfully located various rock strata at depths of up to 40 ft with an accuracy of within two feet. *Chemical Engineering and Mining Review*, v. 52, no. 6, Mar. 15, 1960, p. 70-73.

10390* Intriguing Examples of Geology Applied to Industrial Minerals. Asbestos, barite, B, Br, clays, fluorspar, lime and pozzolan cement, pegmatites, sand and gravel, Ti deposits, sources and utilization are discussed. ***Joseph L. Gillson.*** *Economic Geology*, v. 55, no. 4, June-July 1960, p. 629-644.

10391* A Geochemical Investigation of the Athabasca Bituminous Sands. Metal-porphyrin and porphyrin aggregate contents of the Athabasca oil fractions were determined quantitatively. The metal-porphyrin contents of these fractions corroborated the bulk analyses and revealed the presence of a nickel-porphyrin complex in addition to the previously established predominant vanadium-porphyrin complex. ***J. B. F. Champlin and H. N. Dunning.*** *Economic Geology*, v. 55, no. 4, June-July 1960, p. 797-804.

10392* Critical Remarks on the Genesis of Ore as Applied to Future Mineral Exploration. The syngenetic, metamorphic water, and source bed concept theories are challenged on the basis of a survey of the literature and personal observation. ***Reno H. Sales.*** *Economic Geology*, v. 55, no. 4, June-July 1960, p. 805-817.

10393 Structural Deformation and Ore Deposits. Oklahoma-Kansas Mining Field in Tri-State Mining District. This ore search and development problem was solved progressively by study of the relationship of stratigraphy, structural deformation and metamorphism in this field. Techniques developed in this study have been applied with equal merit in numerous mining districts in the United States, Canada, and Mexico. ***George M. Fowler.*** *Engineering and Mining Journal*, v. 161, June 1960, p. 183-188.

10394 The Origin of Sulphide Ores. Supports the ideas that particular sedimentary environments produce particular types of metalliferous provinces, as do the various types of basic igneous rocks, and that the formation of thermal sulfide ores, as distinct from syngenetic ores, results principally from the application of heat to bodies of rock containing dispersed quantities of metals—a process akin to distillation. ***C. J. Sullivan.*** *Engineering and Mining Journal*, v. 161, June 1960, p. 189-194.

10395 Mineral Processing. Presents 12 flowsheets, of various processes and for various materials. *Engineering and Mining Journal*, v. 161, June 1960, p. 232-243.

10396 A Graphical Method for Calculating the True Value of a Mineral Deposit Traversed by a Drilling. An abacus which is simple to use and which allows the actual value of a formation traversed by drillings to be determined, very quickly and with an excellent approximation, from classical data. *(In French.)* Méthode graphique pour le calcul de la puissance réele d'une formation recoupée par un sondage. ***J. Bonnet and J. Sarcia.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1355, 1959, 3 pp. (QC770 F84.2r Contin.)

10397* Crystal Constitution of Uraninites and Nasturanes (Pitchblendes). For minerals of uraninites—pitchblende series mineragraphic investigation has been carried out; the chemical composition, density and lattice constants were determined; numbers of atoms and formula units in the unit cell were calculated; the crystal structure was determined anew by the neutron diffraction method and the manner of alteration of the structure owing to the degree of oxidation was found. *(In Russian.)* Kristallicheskoe stroenie uranitov i nasturanov. ***E. S. Makarov, I. M. Lipova, I. F. Dolmanova, and A. A. Melik'ian.*** *Geokhimiia*, 1960, no. 3, p. 193-213.

10398* Neutron Radiation of the Earth. The ratio of the amount of fast neutrons to the amount of slow ones decreases with the transition from native rocks to alluvia and farther to water surface. The average neutron flux is 4 neutron/cm^2 hour. *(In Russian.)* Neitronnoe izluchenie zemli. ***V. V. Cherdyntsev, L. I. Shmonin, V. F. Ostapenko, O. D. Khaldeev, and L. L. Kashkarov.*** *Geokhimiia*, 1960, no. 3, p. 261-267.

10399* Absorption of Cosmic Radiation in Iron Meteorites. On the basis of the study of He^3 content in some individual samples of the Sikhote-Allin meteorite shower, a calculation of the average length of cosmic ray adsorption in the meteorite matter was carried out. The calculations were carried out at different ratios of the radii of the post-atmospheric and preatmospheric bodies as well as at different relative positions of their centers of gravity. *(In Russian.)* Pogloshchenie kosmicheskoi radiatsii v zheleznykh meteoritakh. ***L. K. Levskii.*** *Geokhimiia*, 1960, no. 3, p. 274-277.

10400* Ways of Improving Productive Strata Opening in Oil, Gas, Injection and Exploratory Wells. For a more qualitative opening of the stratum during drilling it is necessary, together with improving the quality of the washing solution, to add surface active substances to the solution; this permits better, more rapid and deeper purification of the zone around the well from the filtrate and mechanical impurities. *(In Russian.)* Puti uluchsheniia vskrytiia produktivnykh plastov v neftianykh, nagnetatel'nykh, gazovykh i razvedochnykh skvazhinakh. ***A. Z. Mushin and T. M. Zoloev.*** *Geologiia Nefti i Gaza*, v. 4, no. 5, May 1960, p. 38-42.

10401* Graphic Method of Determining the Position of Gas-Water Contact in Gas Pools. Covers the derivation of the equation of the pressures in the gas deposit and the technique of building a gas-water surface and of determining the periphery of the gas-bearing deposit. *(In Russian.)* Graficheskii metod opredeleniia polozheniia kontakta gaz-voda v gazovykh zalezhakh. ***I. V. Petrov.*** *Geologiia Nefti i Gaza*, v. 4, no. 5, May 1960, p. 46-51.

10402* Investigating the Lunar Atmosphere and Planetary Atmosphere. Consists of 97 abstracts. ***Judy Hayes.*** 16 pp. 1960. Jet Propulsion Laboratory, California Institute of Technology, Pasadena, Calif. (ZQC879 As89 Ref.)

10403* Calculation of the Side Pressure of Gas and Gas Condensated Wells by Surface Measurements. Formulas were developed to determine the discharge of gas condensate by measuring the buffer and circumferential pressure and the shoe and side pressures. *(In Russian.)* Raschet zaboĭnogo davleniia gazovykh i gazokondensatnykh skvazhin po izmereniiam na poverkhnosti. ***E. I. Petrushevskiĭ.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Neft' i Gaz*, v. 3, no. 2, 1960, p. 59-63.

10404* Effects of Temperature on the Viscosity Properties of Petroleum-Based Washing Solutions. When the temperature increases, the plastic viscosity and dynamic shearing stress of petroleum-based solutions are lowered. The character of the t_0 change depends on the structure forming and stabilizing additions such as lime and soaps. Such solutions will be the washing liquids for deep boring. *(In Russian.)* Vliianie temperatury na vizkostnye svoĭstva promyvochnykh rastvorov na neftianoĭ osnove. ***N. M. Kas'ianov and L. K. Mukhin.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Neft' i Gaz*, v. 3, no. 4, 1960, p. 37-41.

10405* Effects of the Size of Mineral Particles of Sandstones on Their Abrasive Capacity. The curve reflecting the change in the abrasive capacity as a function of the size of the rock-forming grains has an extreme point. In the region of low measurements, the abrasive capacity changes with the change of the size of the grains more rapidly than it is the case with relatively large dimensions. *(In Russian.)* O vliianii razmera mineral'nykh chastits peschanikov na ikh abrazivnuiu sposobnost'. ***M. M. Nikanorov and A. I. Ignatiade.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Neft' i Gaz*, v. 3, no. 5, 1960, p. 51-56.

10406* Recent Progress in Solar Physics. Reviews solar cosmic rays and high-energy particles, flares and prominences, coronal condensations, solar magnetic fields, and solar radio noise emission since 1954. ***Walter Orr Roberts and Harold Zirin.*** *Journal of Geophysical Research*, v. 65, no. 6, June 1960, p. 1645-1659.

10407* The Density and Mass Distribution of Meteoritic Bodies in the Neighborhood of the Earth's Orbit. A study of the frequency of meteorite falls in areas which have been highly populated throughout the last century. ***Harrison Brown.*** *Journal of Geophysical Research*, v. 65, no. 6, June 1960, p. 1679-1683.

10408* Stationary Flow in the Planetary Boundary Layer With an Inversion Layer and a Sea Breeze. Shows that an intense temperature inversion virtually acts as a boundary surface which separates a planetary boundary layer into two layers. ***S.-K. Kao.*** *Journal of Geophysical Research*, v. 65, no. 6, June 1960, p. 1731-1736.

10409* A Philosophy for Exploration. The success of an exploration program is largely dependent upon the effectiveness of exploration teams. Putting the teams together is not enough. They must work with skill and with enthusiasm, and every facility must be provided for the continued and uninterrupted search for oil. ***Howard C. Pyle.*** *Journal of Petroleum Technology*, v. 12, May 1960, p. 17-19.

10410* Continuous Mining in Seams Less Than 38 Inches Thick. Stotesbury No. 10 coal mine is averaging 85 tons per man on the section with a continuous mining machine. ***K. S. Hobbs.*** *Mining Congress Journal*, v. 46, June 1960, p. 59-62.

10411 Origin of Chondrules and Chondritic Meteorites. ***Brian Mason.*** *Nature*, v. 186, Apr. 16, 1960, p. 230-231.

10412 Use of Long-Lived Natural Radioactivity as an Atmospheric Tracer. Results of an exploratory survey of the distribution of radium-D, -E, and -F isotopes in air and in rain-water. ***W. M. Burton and N. G. Stewart.*** *Nature*, v. 186, May 21, 1960, p. 584-589.

10413 Communications From Superior Galactic Communities. Considers possibility of interstellar communications. ***R. N. Bracewell.*** *Nature*, v. 186, May 28, 1960, p. 670-671.

10414* The Next Steps in Astronomy: a Russian View. The Catalogue of Faint Stars will greatly help studies of the geometrical and mechanical properties of stars in our galaxy. Optical and radiophysical observations will be coordinated and the pace of space exploration will be kept up. ***A. A. Mikhailov.*** *New Scientist*, v. 7, June 2, 1960, p. 1420-1422.

10415 Continental Shelves Busy as World-Wide Offshore Areas Begin Yielding Their Promised Riches. First of six articles on offshore activity. ***Paul Swain.*** *Oil and Gas Journal*, v. 58, no. 23, June 6, 1960, p. 93-98.

10416 Chemical Application Helps Unload Oil, Gas Wells. Two advancements in the stimulation of production from wells that have been killed by accumulation of water, oil, or well-treating fluid. One generates a large volume of gas at bottom of well, and the other uses a surfactant to induce foaming. ***K. J. Lissant and G. J. Samuelson.*** *Oil and Gas Journal*, v. 58, no. 23, June 6, 1960, p. 124-127.

10417 What To Do If Blowouts Threaten While Drilling. Describes a method for killing blowouts. ***T. B. O'Brien and W. C. Goins, Jr.*** *Oil and Gas Journal*, v. 58, no. 26, June 27, 1960, p. 123-125.

10418 The Limestone Industries of Ontario. ***D. F. Hewitt.*** *Ontario Department of Mines, Industrial Mineral Circular No.* 5, 1960, 177 pp. (QE191 On8.5i Contin.)

10419 A Simple Stereophotographic Field Method of Rock Outcrop Description for the Geologist. Utilizes an ordinary hand camera, an army field-type stereoscope and a simple photographic procedure. A three-dimensional record of stratigraphic structures. ***Rudi A. Prusok and John R. Ege.*** *Photogrammetric Engineering*, v. 26, no. 1, Mar. 1960, p. 98-100.

10420 Photo/Field Prospecting. Demonstrates those terrain features which are significant to the search for primary ore deposits in bedrock; and for secondary or placer accumulations in transported, unconsolidated deposits. ***R. E. Goodman.*** *Photogrammetric Engineering*, v. 26, no. 1, Mar. 1960, p. 100-105.

10421* Meteoritic Dust Measured From Explorer I. Includes a description of the instrumentation, the calibration procedure, and the amount and type of data recorded at the ground stations. ***Maurice Dubin.*** *Planetary and Space Science*, v. 2, nos. 2-3, Apr. 1960, p. 121-129.

10422* Properties of the Upper Atmosphere and Their Relation to the Radiation Belts of the Earth. ***S. F. Singer.*** *Planetary and Space Science*, v. 2, nos. 2-3, Apr. 1960, p. 165-173.

10423 Proceedings of First Symposium on Weather Reconnaissance System Users' Requirements. Concerns application of the AN/AMQ-15 Weather Reconnaissance System. 109 pp. Bendix Aviation Corporation, Ann Arbor, Michigan. (QC879 B43.7p Over.)

10424* Geomagnetic Westward Drift and Irregularities in the Earth's Rotation. ***M. G. Rochester.*** *Royal Society of London, Philosophical Transactions*, v. 252, Ser. A. Mathematical and Physical Sciences, no. 1018, May 26, 1960, p. 531-555.

10425 Meteorite Impact Suggested by Shatter Cones in Rock. ***Robert S. Dietz.*** *Science*, v. 131, June 17, 1960, p. 1781-1784.

10426 Solar Particles and Cosmic Rays. Magnetic fields in the galaxy may constitute an "accelerator" for cosmic rays. Recent studies have examined the question of whether the sun and similar stars inject particles into this accelerator. ***Kinsey A. Anderson.*** *Scientific American*, v. 202, no. 6, June 1960, p. 64-71.

10427* Exploring the Solar System by Radar. A popular description. ***Paul E. Green, Jr. and Gordon H. Pettengill.*** *Sky and Telescope*, v. 20, no. 1, July 1960, p. 9-14.

10428* On the Origin of Sedimentary Dolomites. Basic characteristics of primary chemical and of replacement dolomites belonging to the period of sediment diagenesis are established. Six principal cases of the formation of replacement dolomites after $CaCO_3$ limes are distinguished. (*In Russian.*) O proiskhozhdenii osadochnogo dolomita. ***G. I. Teodorovich.*** *Sovetskaia Geologiia*, v. 3, no. 5, May 1960, p. 74-87.

10429 Technology of Bastnasite. ***J. S. Berber, et al.*** *U. S. Bureau of Mines Report of Investigations* 5599, 1960, 20 pp. (TN21 Un3r Vis.)

10430* Rockets at the Service of High Altitude Research. A survey of some unsolved problems of atmosphere investigation between 40 and 300 km above the earth surface, with emphasis on the value of the newly acquired data for science, economy and daily living, and the necessity of a regular and synoptic use of high altitude rockets, together with other rockets for the investigation of important processes on the sun surface. (*In German.*) Raketen im Dienst der Höhenforschung. ***Heinrich Faust.*** *Weltraumfahrt*, v. 11, June 1960, p. 43-46.

See also: **10351** (ionospheric wave propagation); **10371** (petroleum emulsion films); **10800** (origin of ores).

GRAPHIC ARTS

10431* An Electronic Tone Masking Printer for the Duplication of 35mm Colour Transparencies. The characteristics of Ilford Color are discussed so far as they affect the problem of duplication. The need for a negative contrast mask is established and its ideal characteristic derived. An electronic method is described capable of producing instantaneously a mask of the requisite nature. This is done by modulating the television-type raster on a cathode ray tube acting as the light source for a contact printer. ***D. M. Neale and D. S. Reid.*** *Journal of Photographic Science*, v. 8, no. 3, May-June 1960, p. 85-101.

10432* A Machine for High Speed Printing From 35mm Colour Transparencies. A machine for making color prints at high speed from 35mm transparencies employs one operator to load the transparencies into a storage magazine, from which they are fed into the machine automatically and after printing are unloaded by a second operator. ***J. H. Coote and A. P. Jenkins.*** *Journal of Photographic Science*, v. 8, no. 3, May-June 1960, p. 102-105.

10433* The Estimation of Adenine in Gelation With Reference to Restraining Properties. A colorimetric method is given for the estimation of adenine, a nucleic acid component, in gelatin. In general, hide gelatins are found to contain more adenine than bone gelatins, and the amount present is sufficient to account for restraining properties in the former. ***H. W. Wood.*** *Journal of Photographic Science*, v. 8, no. 3, May-June 1960, p. 113-118.

10434* The Chemical Sensitization of Silver-Iodide Emulsions. The sensitivity of silver-iodide emulsions is shown to be dependent upon the silver-complexes present at the surface of the grains. It is suggested that these complexes increase the useful absorption of light as well as increasing halogen acceptance in the system. ***E. A. Sutherns.*** *Journal of Photographic Science*, v. 8, no. 3, May-June 1960, p. 118-123.

10435 Radial Distortion: Its Calibration, Computation in Non-Gaussian Image Planes, and Compensation. The problem was investigated and formulas were derived for computing distortion in non-Gaussian image-planes. The significance of distortion calibration was reviewed, and a complete set of calibration equations was derived. ***K. Pestrecov.*** *Photogrammetric Engineering*, v. 25, no. 5, Dec. 1959, p. 702-712.

10436 The Future for Photogrammetry and Photo Interpretation. The problem is discussed from many viewpoints. Considers whether a camera can be made to function satisfactorily after being subjected to great acceleration forces at the time of blast-off. ***Robert N. Colwell.*** *Photogrammetric Engineering*, v. 25, no. 5, Dec. 1959, p. 712-736.

10437 Large Scale 70 mm. Color Photography Techniques and Equipment and Their Application to a Forest Sampling Problem. Describes a photographic sampling technique that overcomes the image motion problem by using a fast color film and a 70 mm camera with a fast shutter. Special equipment and methods used in taking the pictures, and in processing and interpreting them, are explained. ***R. C. Aldrich, W. F. Bailey, and R. C. Heller.*** *Photogrammetric Engineering*, v. 25, no. 5, Dec. 1959, p. 747-754.

10438 Can Tilted Photographs Be Assumed Vertical for the Purpose of Calculating Point Elevations? This paper has proven that point elevations calculated from tilted photographs assumed vertical give errors ranging from −3.69% to +3.26%. The cause of such high error lies not in the method of solution but in the basic assumption of zero tilt. ***George Fleming.*** *Photogrammetric Engineering*, v. 26, no. 1, Mar. 1960, p. 50-54.

10439 The Effects of Film Speed and Observer-Control on the Detection of Gross Targets in Aerial Photographs. Six groups of subjects were required to detect gross targets (cities) on a negative film-strip passing over a light table. Three groups could control the rate of film transit, after the film was started at one of three pre-arranged speeds. The mean speeds attained by those groups were used as constant running-speeds for the film-presentations to members of the three No Control groups. ***George S. Grosser and Edward J. Robinson.*** *Photogrammetric Engineering*, v. 26, no. 1, Mar. 1960, p. 66-72.

10440* A High-Speed Color Printer. Salient features of the printer are: automatic operation, two printing beams, high production rate, precoding of negatives, and stable operation. Two negative rolls are handled simultaneously and in synchronism, exposing onto 7-in. wide color print paper. Printer capacity is about 5000 prints per hr for first prints from new negatives. Exposure time is 0.5 sec and cycle time is 1.2 sec per pair of negatives in the two printing beams. Prior to loading negatives into the printer, a precoding machine records a frame index mark plus density and color correction data on the margin of each negative. Precoding includes automatic discrimination between daylight and flash exposures. The 3-sigma limits for log exposure are ±0.012; 3-sigma limits for negative transport are ±1/64-in. ***A. M. Gundelfinger, E. A. Taylor, and R. W. Yancey.*** *Photographic Science and Engineering*, v. 4, no. 3, May-June 1960, p. 141-150.

10441* Photographic Developing Agents: 2. Quinones. Strong developers are formed when many quinones are added to aqueous alkalies, either in the presence or absence of sulfite. In the absence of sulfite, the activity is probably due to a hydroquinone and possibly a hydroxyhydroquinone formed by the addition of the hydroxyl ion. A number of polyhydroxyanthraquinones were found to form developers but were less active than corresponding benzene and naphthalene derivatives. ***R. W. Henn, J. F. Tinker, and H. L. Fielding.*** *Photographic Science and Engineering*, v. 4, no. 3, May-June 1960, p. 167-172.

10442 Introduction to Photographic Instrumentations Engineering. Different fields of the problem are discussed. ***Amron H. Katz.*** *Research/Development*, v. 11, June 1960, p. 16 + 6 pages.

10443* How to Study Mars Without an Astronaut. An M.I.T. group proposes a recoverable, photographic device. *Technology Review*, v. 62, no. 8, June 1960, p. 30 + 1 page.

10444* An Intermittent-Action Camera With Absolute Time Calibration. A detailed description is presented of a film-recording system in which a randomly occurring event and its absolute time are recorded simultaneously. ***G. Hefley, R. H. Doherty, and E. L. Berger.*** *U. S. National Bureau of Standards, Journal of Research, Section C, Engineering and Instrumentation*, v. 64C, no. 2, Apr.-June 1960, p. 159-165.

HEAT POWER

10445 Ideal Performance of Multistage Rockets. Performance is presented in a graphical form especially suited for the systems designer interested in visualizing the intricate relationships between motor propellant fraction, size of the total propulsion system in relation to the payload, and burnout velocity. ***Richard D. Geckler.*** *ARS Journal*, v. 30, June 1960, p. 531-536.

10446 Combustion Instability in Solid Propellant Rocket Motors. ***E. W. Price.*** *ARS Journal*, v. 30, June 1960, p. 574-576.

10447* Non-Propulsive Power Systems for Missiles and Space Vehicles. A static conversion device probably will be employed for a long-time low-power lever application, i.e., communication and illumination. In systems required to operate for durations of from one hour to one month, the H powered system appears to be extremely attractive. ***D. K. Breaux and R. L. Schultz.*** *Canadian Aeronautical Journal*, v. 6, no. 5, May 1960, p. 170-177.

10448* Some Chemistry of Future High-Compression Engines. Concerns knock at various throttle openings, precombustion reactions, deposit formation, surface ignition, and incomplete burning. ***Wheeler G. Lovell.*** *Chartered Mechanical Engineer*, v. 7, no. 6, June 1960, p. 275-285.

10449* Development Experience With Prototype Gas Turbines. ***J. E. Cook.*** *Combustion*, v. 31, no. 12, June 1960, p. 55-60.

10450* Results With a Diesel Car. A report of operation detailing costs and including comments on the simple preventive maintenance system used. ***Brian P. Emerson, editor.*** *Diesel Power*, v. 38, June 1960, p. 30-32.

10451* Ion-Membrane Fuel Cell. Solid electrolyte makes direct chemical-to-electrical energy conversion a practical power source. *Electromechanical Design*, v. 4, no. 6, June 1960, p. 24-26.

10452* A Practical Method of Determining the Varying Slip in the Asynchronous Operation of Turbine Generators. This graphical method makes it possible to draw in a simple way the slip, angle, stator current, and apparent output curves plotted against time for the asynchronous operation of turbine generators. (*In Hungarian.*) Gyakorlati módszer turbogenerátorok aszinkron üzemének vizsgálatára. ***Csáki Frigyes.*** *Elektrotechnika*, v. 53, nos. 2-3, 1960, p. 62-68.

10453 Revolution in Power. Intensified research and development programs will unquestionably have a shocking impact on so-called "conventional" methods of generating, transmitting, and controlling mechanical and electrical power during the decade of the '60's; for instance, a new natural-gas engine which is supercharged and aftercooled. It was developed for low first cost and economical operating cost. This is but one product of a research and development program which last year involved expenditures of about $37 million. An appreciable part of this total was spent on the improvement of engine designs. Nearly every major electrical manufacturing company is pushing programs for the development of "unconventional" methods of generating electrical power such as the fuel cell, thermoelectricity, thermionic conversion in addition to considerable projects in fission and fusion. Even such long-standing mechanical links as the gear shift, transmission, and differential may become obsolete in some designs. The piston engine may yield to the turbine and electric motor, or possibly to revolutionary new internal combustion engines. *Engineering and Mining Journal*, v. 161, June 1960, p. 222-231.

10454* Some Features of the Port Mann Gas Turbine Generating Station. Station is fully automatic, unattended, and controlled remotely from a control room some 15 miles away. Prime function of the plant is to supplement hydrogeneration under adverse water conditions. ***T. Ingledow.*** *Engineering Journal*, v. 43, May 1960, p. 64-67.

10455 What May Be Ahead in Power Production. Considers the role of the steam turbine, the gas turbine, and other forms of power production. ***Glenn B. Warren.*** *Mechanical Engineering*, v. 82, May 1960, p. 61-65.

10456* The Energy Gap and Atomic Power. An address. ***Laughlin M. Currie.*** *Mines Magazine*, v. 50, June 1960, p. 49-52.

10457 ABL'S Altair Runs up 13-13 Record. Details of the X248, an amazingly successful final-stage solid rocket with a 13-13 record for performance. ***Jay Holmes.*** *Missiles and Rockets*, v. 6, no. 23, June 6, 1960, p. 29-30.

10458 Fuel Cells: Will They Soon Become a Major Source of Electrical Energy? A review. ***F. T. Bacon.*** *Nature*, v. 186, May 21, 1960, p. 589-592.

10459 Scientists Study Use of Radiation for Industry at Global Conclave. The First International Conference on the "Uses of Atomic Radiation in Industrial Processing" in the Namoestnikowski Palace in Warsaw, Poland, under the auspices of the International Atomic Energy Agency. ***Etienne J. Guerin.*** *Research/Development*, v. 11, June 1960, p. 76 + 7 pages.

10460* Ions, Plasmas and Photons (Space Ship Drives). A survey of the basic sources of energy, chemical, nuclear and solar, used in space ship drives and connected with the three important parameters: specific impulse, flow-weight ratio of the motor and the specific propulsion weight, and an examination of the systems of distributions of space ship propulsions: limited by the temperature of the material, or using the magnetic decrease of plasma at very high temperature, or electric or electromagnetic acceleration of the drive molecules. (*In Polish.*) Jony, plazmy i fotony (napędy statków kosmicznych). ***Zdzisław Brodzki.*** *Technika Lotnicza*, v. 16, no. 2, Mar.-Apr. 1960, p. 34-39.

10461* Sludge Gas Turbines for Sewage Plant Heat and Power. One of the largest treatment plants in the world will supply its own heat and power with turbines utilizing sludge gas as fuel for the London (England) County Council. *Water & Sewage Works*, v. 107, June 1960, p. 231-232.

See also: **10709** (nondestructive testing of rocket motors).

INFORMATION—PREPARATION AND DISSEMINATION

10462 A Modern Outline of Library Classification. Discusses the limitations of older approaches and their relevance to modern theory. Six major general classifications are described in detail and the practical problems of classifying by them, and indexing them are dealt with. The relations between classification and other forms of indexing, including mechanical methods, are also considered. ***J. Mills.*** 196 pp. 1960. Chapman & Hall, London. (Z696 M62m)

10463 Why Don't They Prepare Better Technical Catalogs? Good ones help the customer; bad ones land in the wastebasket. ***William K. Hollis.*** *Product Engineering*, v. 31, no. 22, May 30, 1960, p. 52-53.

10464 Getting Your Share From Technical Literature? You can spend an hour or so locating what others have published. Or you can plunge right in, eventually solving the engineering problem yourself, and possibly duplicating someone else's work. ***Harold S. Sharp.*** *Product Enigneering*, v. 31, no. 27, July 4, 1960, p. 40-41.

See also: **10386** (bibliography of South Australian geology).

INSTRUMENTATION

10465 On the Theoretical Analysis of a Dynamic Thermocouple. II. The Continuous Area Interface. The dynamic thermocouple formed by the moving junctions of two dissimilar metals is analyzed for the case of two semi-infinite bodies of dissimilar metals. A procedure is given for determining the potential measured by the thermocouple leads placed in the two respective bodies at an infinite distance away from the contact area in terms of the Seebeck emf corresponding to the contact-area temperature distribution. ***W. F. Hughes and E. W. Gaylord.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 259-262.

10466* Miniature Hydraulic Rotary Actuator. Two four-ounce dual-value actuators drive airborne radar antenna. ***James F. Fawcett.*** *Electromechanical Design*, v. 4, no. 6, June 1960, p. 10-12.

10467* The Design of Optical Digital Instruments. Various design considerations for optical digital instruments are first discussed with emphasis placed on the importance of readings being at once available if demanded, as this is desirable in time sharing systems. Some low resolution instruments are then described with notes on the use of the data obtained from them. ***I. R. Young.*** *Electronic Engineering*, v. 32, no. 388, June 1960, p. 359-365.

10468 Efficiency of the Plasma Thermocouple. The efficiency of a thermionic converter containing Cs ions is calculated for the regime, in which the plasma density is sufficiently high. The output voltage V is determined for various currents by a consistent solution of the electrical and thermal conduction problems. The efficiency of the thermocouple is then deduced from the calculated current-voltage characteristic and the appropriate electron temperature distribution. ***H. W. Lewis and J. R. Reitz.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 723-727.

10469 Mechanical Design of Laboratory Apparatus. The need to consider mechanical design, the principles of design, designing for construction are discussed. ***H. J. J. Braddick.*** 47 pp. 1960. Reinhold Publishing Corp., New York. (Q185 B72m)

10470 An Automatic Dew-Point Hygrometer Using Peltier Cooling. Progress in the field of semiconductors has opened up more and more new applications. Describes an automatic dew-point hygrometer in which the necessary cooling is produced by the Peltier effect of a certain combination of semiconductors. ***P. Gerthsen, J. A. A. Gilsing, and M. van Tol.*** *Philips Technical Review*, v. 21, no. 7, June 1960, p. 196-200.

10471 A Transistorized Radiation Monitor. This article adds the first measuring instrument to the long list of transistor-equipped devices that have been described in this Review in recent years. The emphasis here lies on the special requirements the circuit of a measuring instrument has to satisfy. ***M. van Tol and F. Bregman.*** *Philips Technical Review*, v. 21, no. 7, June 1960, p. 201-206.

10472 Variable Capacitance Liquid Level Sensors. The properties of continuous variable capacitance liquid level gages are analyzed, and the inter-relations of hydraulic and electrical properties are examined. The analysis covers both conductive and nonconductive liquids and considers the "flowback" effects found in dynamic level fluctuations. ***L. Bruce Wilner.*** *Review of Scientific Instruments*, v. 31, May 1960, p. 501-507.

10473 High Pressure High Temperature Optical Device. The high pressure optical cell previously described in the literature has been modified to permit measurements to 400 C and 200,000 atm. The operating details and methods of temperature and pressure calibration are discussed. The absorption edges of sulfur and of olivine are presented as a function of temperature and pressure. ***A. S. Balchan and H. G. Drickamer.*** *Review of Scientific Instruments*, v. 31, May 1960, p. 511-513.

10474 Shielded Coaxial Leads for Low Temperature Electrical Measurements. The problem of making electrical contact to apparatus at very low temperatures is discussed, with particular reference to dielectric constant measurements in a situation where multiple shielding is required. Examples are given of easily constructed rigid electrode leads suitable for use at low temperatures, which have low thermal conduction, low and stable inter-conductor capacitance and conductance. ***Norman L. Brown and Richard N. Barfield.*** *Review of Scientific Instruments*, v. 31, May 1960, p. 517-519.

10475 High Temperature High Vacuum Resistance Furnace. An experimental high temperature high vacuum furnace with self-supported W resistance heating elements is described. The furnace is assembled from readily obtainable parts, and knife-edge vacuum seals are used throughout. ***Juluis Cohen and William Eaton.*** *Review of Scientific Instruments*, v. 31, May 1960, p. 522-525.

10476 Optically Calibrated Infrared High Pressure Cell. A high pressure optical cell of large aperture has been constructed for use in pressure broadening studies of gases in the infrared region of the spectrum. The cell is tight at both vacuum and 1000 psi and is constructed of stainless steel with 3 x 1-in. calcium fluoride windows. A method of measuring short path length cell spacing to an accuracy of 1% using an optical "butterfly" is described. ***Donald E. Williamson, Ivan A. Nichols, and Bertram Schurin.*** *Review of Scientific Instruments*, v. 31, May 1960, p. 528-532.

LUBRICATION AND FRICTION

10477 Flow Parameters in Hydrostatic Lubrication for Several Bearing Shapes. Several pad shapes and associated oil inlets were investigated using conformal mapping techniques to obtain the total load-carrying capacity, flow rate of oil, oil-film thickness, pressure and velocity distribution. ***S. Raynor and A. Charnes.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 257-264.

10478 A General Method for Correlating Labyrinth-Seal Leak-Rate Data. Suitable accuracy, particularly for straight labyrinth seals, can only be obtained from actual seal tests. A method for correlating test data is presented which allows calculation of the leak rates for an entire family of labyrinth seals on the basis of tests of only two characteristic seals. ***F. E. Heffner.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 265-275.

10479 Hydrostatic Gas Bearings. Based on Euler's equation, expressions for the significant parameters, i.e., pressure profile, gas-flow rate, gap height, and load-carrying capacity of pad and step bearings, are developed. These parameters yield results which are in excellent agreement with experimental data. ***John H. Laub.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 276-286.

10480 Effect of Hardness, Surface Finish, and Grain Size on Rolling-Contact Fatigue Life of M-50 Bearing Steel. Considerable testing on the RC Rig and statistical-treatment methods are included. A mathematical expression relating these variables to life expectancy is presented and the optimization of these variables is discussed. ***R. A. Baughman.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 287-294.

10481 The Importance of Spinning Friction in Thrust-Carrying Ball Bearings. Balls were rolled on flat plates and in V-grooves at loads and contact angles corresponding to usual thrust-bearing practice. It is shown that the spinning action of the ball with respect to the race should account for the major part of the over-all friction of a thrust-carrying ball bearing. ***G. S. Reichenbach.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 295-301.

10482 A General Theory for Elastically Constrained Ball and Radial Roller Bearings Under Arbitrary Load and Speed Conditions. A completely general solution is obtained whereby the elastic compliances of a system of any number of ball and radial roller bearings under any system of loads can be determined. Elastic yielding of the shaft and supporting structure are considered as well as centrifugal and gyroscopic loading of the rolling elements under high-speed operation. ***A. B. Jones.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 309-320.

10483 A Sommerfeld Solution for Finite Bearings With Circumferential Grooves. A method of solution is developed that circumvents the algebraic complexity in the solution of Reynolds differential equation applied to full journal bearings. The method leads to equations for journal-bearing characteristics that are in finite form. ***J. V. Fedor.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 321-326.

10484 Bearing Oil-Ring Performance. A series of tests was made with rings ranging from 2¾ to 16½ in. ID and at journal speeds up to 4000 fpm. Correlation of the results provides means for calculating ring speed for any journal speed. From this calculated ring speed, oil delivery can then be estimated from equations incorporating the effect of oil viscosity and related operating factors. ***D. C. Lemmon and E. R. Booser.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 327-334.

10485 Torque Produced by Misalignment of Hydrodynamic Gas-Lubricated Journal Bearings. A perturbation analysis is used to find the torque generated by a misaligned journal bearing. Results are presented graphically in terms of non-dimensional parameters. ***J. S. Ausman.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 335-341.

10486 A Study of the Stability of Externally Pressurized Gas Bearings. The pertinent equations of motion are linearized and the stability criteria stated in terms of small deviations from the equilibrium operating point. The flow in the bearing clearance is treated on a distributed rather than on a lumped-parameter basis. ***Lazar Licht and Harold Elrod.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 250-258.

10487 Tension, Compression, and Fatigue Properties of Several Steels for Aircraft Bearing Applications. The static tensile and compressive properties, and the rotating-beam fatigue strength for several heats of SAE 52100 and three vacuum-melted tool steels were established at room and elevated temperatures and over a range of hardnesses. ***G. Sachs, R. Sell, and W. F. Brown, Jr.*** *American Society for Testing Materials, Proceedings*, v. 59, 1960, p. 635-654. (TA401 Am3tp Vis.)

10488* An Appraisal of Synthetic Lubricants in Aircraft Gas Turbines. Aircraft gas turbine engines have created lubrication demands which are unique compared with those of the piston engine. The inability of conventionally refined petroleum oils to satisfy both low and high temperature requirements resulted in the development of ester base synthetic oils. Reviews the historical development of those lubricants in the light of changing engine requirements. ***J. P. Perry.*** *Canadian Aeronautical Journal*, v. 6, no. 5, May 1960, p. 156-163.

10489* A Service Evaluation of Detergent Lubricating Oils Utilizing Electron Microscopy. Confirming the results of previous low-duty tests, the effective detergency devel in used, detergent lubricating oils can be determined by electron microscopy. The detergency requirement of an engine increases with increasing engine mileage. ***S. R. Rouze and F. A. Forster.*** *Lubrication Engineering*, v. 16, May 1960, p. 222-227.

10490* Frictional Resistance of a Radially-Loaded Journal Bearing With Grease Lubrication. The principal variable studied was the frictional resistance or torque as it was related to the grease composition at various speeds and radial loads. Results of the investigation indicated that the behavior of the Li greases studied were generally similar to that of a Bingham plastic. ***Rajat K. Chakrabarti and Ralph J. Harker.*** *Lubrication Engineering*, v. 16, June 1960, p. 274 + 7 pages.

10491* Grease Mixer Design. Principles for multi-action mixers. ***K. G. Timm.*** *NLGI Spokesman*, v. 24, no. 3, June 1960, p. 87-94.

See also: **10650** (friction of sliding surfaces undergoing subsurface plastic flow).

MECHANICAL ENGINEERING

10492 Use of the Moiré Effect to Measure Plastic Strains. A method is described which should prove useful in the study of strain distribution in a metallic member during plastic deformation. Regularly spaced lines are drawn on a test specimen of interest and on a glass plate. After exposure to strain the part is photographed through the grid of lines on the glass. ***A. Vinckier and R. Dechaene.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 426-434.

10493 Design of Pressurized Cylinders for High-Temperature Applications. General equations for the stresses in a thick-walled cylinder in a state of plane strain are derived considering "steady-state" creep. A specific form of the creep-rate function is assumed. ***J. F. Traexler.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 477-481.

10494 On the Annular Damper for a Freely Precessing Gyroscope. The dynamics of a damper that has been used to eliminate the free precession of flying, spinning objects are analyzed. There are three regimes in which the details of the mechanism by which the viscous fluid dissipates the precessional energy differ markedly, and the fluid motion and energy-dissipation rate are described quantitatively for each regime. ***G. F. Carrier and J. W. Miles.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 237-240.

10495 Normal Modes of Nonlinear Dual-Mode Systems. A system consisting of two unequal masses, interconnected by a coupling spring, and each connected to an anchor spring, is examined. The springs may all be unequal and nonlinear, but each resists being compressed to the same degree as being stretched. The concept of normal modes is rigorously defined, and methods of finding them are given. ***R. M. Rosenberg.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 263-268.

10496 Classical Normal Modes in Damped Linear Dynamic Systems. It is shown that a necessary and sufficient condition for the existence of classical normal modes is that the damping matrix be diagonalized by the same transformation that uncouples the undamped systems. ***T. K. Caughey.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 269-271.

10497 The Approximate Analysis of Certain Boundary-Value Problems. A simple method is given which is suitable for the approximate analysis of certain boundary-value problems, including, for example, the small deflections of clamped plates and the torsion of prismatic bars. The method is applied here to four problems, the uniformly loaded, clamped square, and equilateral-triangle plates, and the torsion of bars of square and hexagonal cross section. ***H. D. Conway.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 275-277.

10498 Stresses in a Slab Having a Spherical Cavity Under Circular Bending. Investigates the effect of a spherical cavity in a solid of revolution when the solid is acted on by a given stress system symmetrical to the axis of revolution. ***Chih-Bing Ling and Chen-Peng Tsai.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 278-282.

10499 Elastic Equilibrium of a Plate With a Reinforced Elliptical Hole. An infinite thin plate is subjected to loads in the plane. A solution to the generalized plane-stress problem is obtained using the complex variable techniques of Muskhelishvili. The result is presented in a form well suited to evaluation by digital computers. ***Eugene Levin.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 283-288.

10500 Thermal Stress in a Viscoelastic-Plastic Plate With Temperature-Dependent Yield Stress. Equations are given for the determination of transient and residual stresses in plates subject to transient temperature distributions, based on the assumption of a viscoelastic, perfectly plastic material obeying a von Mises temperature-dependent yield condition. It is found that, for steel, viscoelasticity has little effect on the residual stress distribution, but the temperature dependance of yield stress is important. ***H. G. Landau, J. H. Weiner, and E. E. Zwicky, Jr.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 297-302.

10501 On the Plastic Behavior of Rotating Cylinders. Equations for strain and stress distribution in hollow rotating cylinders are developed. The deformations are considered to be of such magnitude, that the use of finite-strain theory is necessary. ***F. P. J. Rimrott.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 309-315.

10502 On the Optimum Design of Shells. A procedure is developed for obtaining the design of an elastic, perfectly plastic shell or structure which will support prescribed loads and which is the optimum design for a given criterion. The action of body forces is included in the analysis. ***R. T. Shield.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 316-322.

10503 Yield Conditions for Rotationally Symmetric Shells Under Axisymmetric Loading. The yield condition may be represented as a surface in a four-dimensional stress space. A new approximation is suggested which combines the advantages of mathematical simplicity and reasonable accuracy. ***P. G. Hodge, Jr.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 323-331.

10504 Postbuckling Behavior of Rectangular Plates With Small Initial Curvature Loaded in Edge Compression. The stress state in the buckled plate is investigated and numerical results for the square plate are given graphically. ***Noboru Yamaki.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 335-342.

10505 The Junction Problem of Solid-Slotted Cylindrical Shells. Presents a solution for the problem of three cylindrical shells, one of which is slotted lengthwise. With slot length as one of the parameters, the solution includes the solid three-shell problem as a particular case. The results are applicable to the stress problem of a closed-end vessel supported either by a slotted or an ordinary skirt. ***D. H. Cheng and N. A. Weil.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 2, June 1960, p. 343-349.

10506* A Non-Linear Bending Effect When Certain Unsymmetrical Sections Are Subjected to a Pure Torque. During a preliminary investigation leading to an examination of the behavior of angle-section members as struts, a peculiar bending under the action of a pure torque was noticed. This effect, while similar in origin to the non-linear shortening effect examined by Weber and Cullimore, has not been previously noticed. A satisfactory explanation can be found by considering elastic effects only. ***M. Gregory.*** *Australian Journal of Applied Science*, v. 2, no. 1, Mar. 1960, p. 33-84.

10507 Measurement of Cyclic Srtain. Describes a versatile multi-way instrument for measuring periodic strain gage signals. The strain is either shown on a meter or can be accurately measured on an oscilloscope in terms of resistance change. ***T. M. Dowell and J. A. MacKinnon.*** *Journal of Scientific Instruments*, v. 37, Apr. 1960, p. 138-140.

10508* The Classical Torsion Problem for Sections With Curvilinear Boundaries. Deals with the application of complex variable analysis to obtain solutions for the Saint-Venant torsion

problem corresponding to certain sections with regular curvilinear boundaries. The area of the cross-section is conformally mapped on the unit circle by a transformation involving some parameters. By varying these parameters, various shapes having several axes of symmetry are obtained. ***W. A. Bassali.*** *Journal of the Mechanics and Physics of Solids*, v. 8, no. 2, May 1960, p. 87-99.

10509* Yielding of Steel Sheets Containing Slits. Yielding at the end of a slit in a sheet is investigated, and a relation is obtained between extent of plastic yielding and external load applied. To verify this relation, panels containing internal and edge slits were loaded in tension and lengths of plastic zones were measured. ***D. S. Dugdale.*** *Journal of the Mechanics and Physics of Solids*, v. 8, no. 2, May 1960, p. 100-104.

10510* A General Theory of Inelastic Column Failure. I.-II. A continuum theory of uniqueness for general inelastic solids is applied to the basic column problem for any such material. The column is long, with arbitrary section, built in at one end, and axially loaded in compression at the other. A critical condition for bifurcation is obtained, generalizing and correcting the Shanley tangent-modulus formula. General sufficient conditions are formulated for either dynamic stability or instability under dead loading. These indicate a criterion of stability, and the corresponding critical load is calculated for a built-in column under compression. ***R. Hill and M. J. Sewell.*** *Journal of the Mechanics and Physics of Solids*, v. 8, no. 2, May 1960, p. 105-118.

10511* Bending of a Singularly Loaded Thin Circular Annulus With Free Boundaries. Series solutions are presented for the complex potentials and deflection of a thin circular annular plate of constant thickness under any system of concentrated forces or concentrated couples in equilibrium, the edges of the annulus being free. The limiting cases when the radius of the inner edge tends to zero or the radius of the outer edge tends to infinity are investigated and exact solutions in closed forms are deduced. ***W. A. Bassali.*** *Journal of the Mechanics and Physics of Solids*, v. 8, no. 2, May 1960, p. 123-140.

10512 Thermal Stresses in Design. XVII. Determining a Safe Working Stress. Techniques for determining a strength value for brittle materials under simulated service conditions. ***S. S. Manson.*** *Machine Design*, v. 32, June 9, 1960, p. 159-165.

10513 Pneumatic-Power Systems. I. Applications and Component Selection. Compressed air power is advantageous when the system operates in an explosive atmosphere, in conjunction with critical processes, or in the vicinity of open flames. ***I. Leonard Kaplan.*** *Machine Design*, v. 32, June 23, 1960, p. 120-124.

10514 Equivalent Spring Mass. The problem how to find the equivalent form of spring-mass combinations for simplified analysis of system vibration is discussed. ***Ferdinand Freudenstein.*** *Machine Design*, v. 32, June 23, 1960, p. 160-162.

10515 High-Temperature Static Seals From Metal Fiber Composites. Impregnating a metal felt with a compatible soft metal gives an unusual material that will seal 5000-psi air at 1000 F. ***M. Sabanas.*** *Product Engineering*, v. 31, no. 22, May 30, 1960, p. 57-61.

10516* The Large-Scale Crumpling of Thin Cylindrical Columns. When a very thin metal tube of cylindrical section is compressed between parallel platens, its walls tend to buckle in and out to form a diamond pattern of deformation around the tube. This paper considers the subsequent behavior of such tubes when the compression is continued to cause large-scale crumpling of the tube walls. ***Alfred Pugsley and M. Macaulay.*** *Quarterly Journal of Mechanics and Applied Mathematics*, v. 13, pt. 1, Feb. 1960, p. 1-9.

10517* The Thin-Walled Circular Cylinder Subjected to Concentrated Radial Loads. Using a new equation governing the radial displacement of a thin-walled circular cylinder, expressions are obtained for this displacement and the resultants in an infinitely long cylinder subjected to equal and opposite concentrated radial loads. ***L. S. D. Morley.*** *Quarterly Journal of Mechanics and Applied Mathematics*, v. 13, pt. 1, Feb. 1960, p. 24-37.

10518* Advances in Floated Gyro Design. Advances in two areas are described: development of a high-performance symmetrical rotor and integral bearing assembly, and application of a new general analytical technique for achieving isoelasticity. ***William D. Johnston and Norman F. Toda.*** *Sperry Engineering Review*, v. 13, no. 2, June 1960, p. 19-25.

10519 Combinations of Shear, Compressive Thermal, and Compressive Load Stresses for the Onset of Permanent Buckles in Plates. A semiempirical method of evaluating the onset of permanent buckles in plates is given. The results indicate that the compressive load stress which a plate can support at the onset of permanent buckles is reduced by thermal compressive stresses and by shear stresses. Results of the method are compared with experimental values for the onset of permanent buckles obtained from tests of square tubes of 17-7 PH (Condition TH 1050) stainless steel. ***George W. Zender and John B. Hall, Jr.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-384, May 1960, 26 pp. (TL570 Un3t Vis.)

10520 On Reissner's Theory of the Bending of Plates. E. Reissner's theory and B. F. Vlasov's theory on the same problem are discussed. ***A. L. Goldenveizer.*** *U. S. National Aeronautics and Space Administration, Technical Translation, NASA TT*-F-27, May 1960, 16 pp. (TL570 Un3tm Vis.)

See also: **10590** (design of high-pressure steam equipment); **10591** (effect of internal pressure on creep of tubing); **10592** (stresses in tubes).

METALLURGY

10521 Refractory Materials. I. Technology and Low-Temperature Behavior. Deals with the general technology of refractory materials—that is, their availability, methods of extraction consolidation to primary shapes, and fabrication to secondary shapes and end items. The stability of the refractory materials (thermodynamic, chemical stability in service environments, and thermal stability after use) is discussed in general terms. Last, the mechanical behavior at low temperatures, particularly the low-temperature brittleness problem, is discussed. ***Robert I. Jaffee and Daniel J. Maykuth.*** *Aero/Space Engineering*, v. 19, June 1960, p. 22 + 6 pages.

10522 Beta Titanium. Design properties and fabrication characteristics of a heat-treatable titanium alloy that is far superior to steel on a strength-to-weight basis. ***E. F. Erbin.*** *Machine Design*, v. 32, June 23, 1960, p. 132-139.

10523* Austenitic Manganese Steels. The results of studies leading to the improvement of wear resistance and mechanical properties of cast austenitic manganese steels is presented. Modifications in composition and heat treatment were studied. ***T. E. Norman, D. V. Doane, and A. Solomon.*** *Modern Castings*, v. 37, June 1960, p. 73-86.

10524 Studies of Heat-Resistant Alloys. Results are reported for an investigation that was carried out to show the effect of hot working on the structure and creep-rupture properties of heat-resistant alloys. Three types of materials were studied: a commercially-pure metal ("A" Nickel), a precipitation-strengthened, austenitic alloy (A-286), and a low-alloy, ferritic steel ("17-22-A"V"). A second phase of the investigation dealt with the effects of strain-aging-type phenomena on strength at high temperatures. ***A. Phillip Coldren, Jerry E. White, Ronald K. Bowen, and James W. Freeman.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 59-606, Feb. 1960, 97 pp. (TL507 Un3.18w Vis.)

METALS—CORROSION

10525 Atmospheric Exposure of Wrought Aluminum and Magnesium Alloys. In considering the aluminum alloys, it appears that the unclad Al-Cu samples show the greatest decrease in strength and ductility after exposure. With reference to the magnesium alloys, the MlA code shows the greatest decrease in strength and ductility. ***L. H. Adam and Marie Dougherty.*** *American Society for Testing Materials, Proceedings*, v. 59, 1960, p. 289-314. (TA401 Am35p Vis.)

10526 New Corrosion Inhibitor. DuPont is developing a corrosion deterrent to increase shelf-life of some aerosol products, based upon new theory that HCl is formed by reaction between EtOH and the propellant. *Chemical Week*, v. 86, no. 23, June 4, 1960, p. 57.

10527* Sodium Chromate Inhibitor in an Ethylene Glycol Engine Coolant. Laboratory tests were made to determine the suitability of sodium chromate inhibitor for ethylene glycol engine coolant. Indications were that chromate inhibitors could be used with ethylene glycol in the absence of light in cases where a laboratory evaluation had been made of operational factors. ***Leonard C. Rowe.*** *Corrosion*, v. 16, June 1960, p. 93.

10528* Effect of pH on Oxygen Corrosion at Elevated Pressures. A summary study of oxygen corrosion of mild steel in brine is presented. Corrosion rates were determined for oxygen pressures ranging from atmospheric to 515 psi and over a pH range of 1 - 13.5. All tests were conducted at room temperature (24 C). It is shown that corrosion rates are generally increased with increasing oxygen pressure and decreasing pH. ***O. L. Riggs, Jr., J. D. Sudbury, and Merle Hutchison.*** *Corrosion*, v. 16, June 1960, p. 94-98.

10529* Recording Electrical Resistance Corrosion Meters. The use of the electrical resistance method for determining corrosion rates has been increasingly rapidly during the past five years. Continuous recording of the results of such tests makes it possible to determine when corrosion occurs in order that additional studies can be made to show how it occurs. Described laboratory tests demonstrate the usefulness of the equipment for corrosion studies. ***E. C. Winegartner.*** *Corrosion*, v. 16, June 1960, p. 99-104.

10530* Effect of Chromium Depleted Surface on Corrosion Behavior of Type 430 Stainless Steel. Loss of Cr during steel mill processing is discussed together with the effect of this Cr depleted surface on atmospheric corrosion. A bench test for rapidly identifying the presence of Cr depleted surface is described and correlated with outdoor exposure tests. ***R. V. Trax and J. C. Holzwarth.*** *Corrosion*, v. 16, June 1960, p. 105-108.

10531* Corrosion Control in Petroleum Refineries Processing Western Canadian Crude Oils. Hydrogen sulfide and other sulfur compounds, together with hydrochloric acid are the chief factors in the corrosion of crude distillation units. Preventive measures include desalting, use of alloy materials, neutralization of the hydrochloric acid, and the use of film forming organic inhibitors. ***C. L. Easton.*** *Corrosion*, v. 16, June 1960, p. 109-114.

10532* Hydrogen Corrosion in Organic Reactor Coolants. Zr and Zircaloy-2 were exposed to organic reactor coolants at temperatures up to 400 C. The hydriding of Zr was found to be independent of the presence of the organic coolant and dependent on the temperature, hydrogen partial pressure, and the presence of an oxide film on the metal. ***V. H. Troutner.*** *Corrosion*, v. 16, June 1960, p. 115-119.

10533* High Temperature Corrosion Problems in the Reduction of Nickel Copper Ores. A review is given of certain high temperature corrosion problems involved in the reduction of Canadian-mined nickel copper ores. Emphasis is placed on the proper selection of materials for various pieces of mining and processing equipment. ***R. J. Law.*** *Corrosion*, v. 16, June 1960, p. 120-122.

10534* Cathodic Protection of Prestressed Concrete Pipe. Prestressed concrete pipe has the reinforcement either partly embedded in the concrete core or totally placed over the core under a cement mortar cover. The lines have the advantage of being suitable for cathodic protection. The feeding points must be spaced closer due to stronger attenuation. ***M. Unz.*** *Corrosion*, v. 16, June 1960, p. 123-131.

10535* Experiments on the Prevention of Pitting Attack on Cast Iron Propellers by Cathodic Protection. Fully-shrouded anodes have reduced the pitting attack on the propellers of vessels, but half-shrouded anodes have almost eliminated the attack on the propellers of vessels. ***R. I. Higgins and H. H. Collins.*** *Corrosion Prevention & Control*, v. 7, Apr. 1960, p. 49-58.

10536 Corrosion Resistance of Titanium. For most corrosion-resistant applications, commercially pure Ti is chosen in preference to titanium alloys. The alloys offer no advantage in corrosion resistance over the pure metal, which is easier to fabricate. ***A. C. Wood.*** *Corrosion Technology*, v. 7, May 1960, p. 135-138.

10537 Aluminium-Nickel-Iron Alloys Resistant to Corrosion by Water at High Temperature. Their Basic Properties—Their Improvement. Reviews the development of the investigations carried out on these alloys showing the establishment of their fundamental, particularly structural, properties. Studies on the penetration process in corrosion, and the role of Ti and Zr additions on rolled metal. The influence of solder on these alloys was studied, showing up the part played by the structure gradients introduced by fission. (*In French.*) Les alliages aluminium-nickel-fer résistant à la corrosion par l'eau à haute température. Bases de leurs propriétés—leur amélioration. ***H. Coriou, R. Fournier, L. Grall, and J. Hure.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1313, 1959, 24 pp. (QC770 F84.2r Contin.)

10538* How to Avoid Formation of Corrosion Products and Resinous Deposition in Town Gas Lines. A review of the studies carried on since 1911 concerning the corrosion of pipe walls through the purification masses. Corrosion has been eliminated by the oil washing of the gas flow and decrease of the O content of the gas. (*In German.*) Die Bildung von Korrosionsprodukten und harzartigen Ablagerungen in Stadtgasleitungen und ihre Vermeidung. ***D. P. Banerjee.*** *GWF; Gas- und Wasserfach* (Gas), v. 101, no. 23, June 3, 1960, p. 594-595.

10539 The Corrosion Protective Characteristics of Decorative Chromium Plate. From a study of chromium plate quality as related to plating conditions, ranges were established for depositing crackfree and nearly porefree chromium, which inhibited corrosion in the nickel plate on which the chromium was deposited. The crackfree and porefree chromium also inhibited basis-metal corrosion in copper- and nickel-plated zinc die castings. ***W. H. Safranek, H. R. Miller, and C. L. Faust.*** *Plating*, v. 47, May 1960, p. 513-519.

10540* Accelerated Corrosion Testing. The salt-spray test is a useful accelerated corrosion test if used wisely and as intended. Significant details of the historical summation of the 46-year-old salt-spray test are presented. There are twenty salt-spray cabinet variables presented and the latest information available to eliminate or minimize the effects of these variables to produce a standardized test method. ***Allen Frank.*** *Plating*, v. 47, June 1960, p. 623-631.

10541* Correlation of Outdoor Exposure, Service and Accelerated Tests on Chromium Plated Bright Work. There may be some danger of being lulled into a sense of false security, if we predict the serviceability of plated articles entirely on the basis of the accelerated tests. The striking improvement in test results of thin bright Ni deposits resulting from the application of very thin Cr, particularly in the Corrodkote test, is a case in point. ***R. B. Saltonstall and D. R. Millage.*** *Plating*, v. 47, June 1960, p. 637-644.

10542 Effect of Heat Flux on the Corrosion of Aluminum by Water. I. Experimental Equipment and Preliminary Test Results. The test results indicate that the temperature of the Al cladding on the fuel elements of the High-Flux Isotope Reactor will be higher than calculated, assuming clean Al surfaces, and that the extent of corrosion must be reduced either by the addition of inhibitors to the water or by the use of an alloy more corrosion resistant than 1100 aluminum. ***J. C. Griess, H. C. Savage, T. H. Mauney, and J. L. English.*** *U. S. Atomic Energy Commission, ORNL-2939*, May 13, 1960, 46 pp. (UF767 U3o Contin.)

METALS—EXTRACTION AND REFINING

10543* Reduction of Sinciferous Agglomerates by Means of Methane Gas. The values of the free energy for the most important reactions of reduction by means of CH_4, C, H_2, and CO were calculated. A Zn agglomerate containing 58.4% Zn, 1.4% S, 9.7% Fe, etc., was subjected to reduction processes. The influence of the following factors was studied: Temperature

800 ÷ 1200 C, methane gas yield 3.5 ÷ 78 l/hr, process duration 30 ÷ 150 min. (*In Rumanian.*) Reducerea aglomeratelor zincoase cu ajutorul gazului metan. ***Al. Lupu, M. Ienciu, and T. Segărceanu.*** *Academia Republicii Populare Romine, Centrul de Cercetări Metalurgice, Studii şi Cercetări de Metalurgie,* v. 5, no. 1, 1960, p. 63-86 + 2 plates.

10544 Basic Oxygen Furnace Refractories. Studies on tar-bonded dolomite-magnesia refractories indicate no apparent correlation between service and interval of time between receipt and burn-in. Higher silicon metal appears to lessen service life; linings with longer time intervals between heats give shorter service. ***B. L. Dorsey.*** *American Ceramic Society Bulletin,* v. 39, May 1960, p. 261-263.

10545 Extractive Metallurgy. The sources of metals, ore dressing, chemical principles, the structure of metals and alloys, fuels and refractories, pyrometallurgy, hydrometallurgy, electrometallurgy, ingots are discussed. ***Joseph Newton.*** 532 pp. 1959. John Wiley & Sons, New York. (TN665 N48e)

10546 Techniques of Pig-Iron Production. It is concluded that in normal circumstances no other process is as yet so efficient as the blast-furnace. *Foundry Trade Journal,* v. 108, May 19, 1960, p. 615-619.

10547* Thermal Stresses in Ingot Molds. (*In Czech.*) Tepelné namáhání ocelářských kokil. ***Frantisek Havlíček.*** *Hutnické Listy,* v. 15, no. 5, May 1960, p. 371-378.

10548* The Automatic Control of Open Hearth Furnaces. The illustration shows two total radiation pyrometers focused on to the roof, one at each end. It sights through a hole in the back wall of the furnace to a point in the crown and care must be taken to ensure that as far as possible the line of sight is not intercepted by the flame as this will cause inaccuracies in the reading obtained. The furnace pressure control, reversal control, oxygen control and control panels are described in detail. ***Keith A. Steele.*** *Instrument Practice,* v. 14, June 1960, p. 647-652.

10549 The Use of Excess Air During the Ignition of a Low-Grade Sinter Mix. The effect of introducing excess air during ignition both through the ignition burner and by induced draught was studied and the effect of this upon subsequent sinter strength determined. ***D. F. Ball.*** *Iron and Steel Institute, Journal,* v. 194, pt. 4, Apr. 1960, p. 479-484.

10550* Production of Germanium for Electronic Use. A chemical process has been developed for the preliminary purification, passing through $GeCl_4$. By hydrolysis of the tetrachloride a pure oxide is obtained and this is then reduced with H. The metal is finally zone refined. The equipment for production of single crystals and for the measurement of their electronic properties is also described. (*In Italian.*) Studi sulla preparazione del germanio per usi elettronici. ***G. Baralis, G. Chilosi, M. Marone, and F. Saraceno.*** *Metallurgia Italiana,* v. 52, Apr. 1960, p. 145-151.

10551* Vacuum Metallurgy. Production equipment such as mechanical, diffusion and vapor booster pumps are discussed. Induction vacuum melting, vacuum heat treatment, vacuum die casting, and vacuum distillation are described. ***W. H. Dennis.*** *Mining Magazine,* v. 102, no. 5, May 1960, p. 278-287.

10552* Oxygen Converter Processes. Discusses the main features of the bottom blown converter process using air, oxygen-enriched air and oxygen-steam mixture, and the top blown oxygen process represented by the LD and LD-AC (lime injection) processes. ***H. F. Padbury.*** *Refractories Journal,* v. 36, May 1960, p. 118-122.

10553* Investigations on the Formation and Precipitation of Deoxidation Products. Investigations on the mechanism of the formation of the oxide phases in molten steel taking into account the reactions occurring between the O of the Fe and Si, Al, Ti, Zr and some deoxidation alloys of commercial importance. Results obtained with melts elaborated in the laboratory and plain carbon steel melts elaborated in the 3-ton electric arc furnace. (*In German.*) Untersuchungen über die Bildung und Abscheidung von Desoxydationsprodukten. ***Erwin Plöckinger and Manfred Wahlster.*** *Stahl und Eisen,* v. 80, no. 10, May 12, 1960, p. 659-669.

10554 Thermochemistry for Steelmaking. Physical and thermochemical properties, standard heats and free energies of formation, and vapor pressures of selected elements and compounds are discussed. ***John F. Elliott and Molly Gleiser.*** v. 1. 296 pp. 1960. Addison-Wesley Publishing Co., Inc., Reading, Mass. (QD515 EL58t)

METALS—FINISHING, POLISHING, AND CLEANING

10555* Embrittlement of Steel by Hydrogen During Pickling or Electrolytic Coating. Embrittlement during pickling in acid or alkaline, cathodic or anodic baths, with or without inhibitors as well as the brittleness of steel samples after electrolytic deposition of Zn, Cd, Cu, Ag, Ni, Cr, Sn and Sn alloys were studied under variation of the composition of the solutions and of the admixtures. The recovery of ductility by annealing for long periods of time was also examined. (*In French.*) Fragilisation de l'acier par l'hydrogène au cours du décapage et du revêtement électrolytique. ***Uno Trägårdh.*** *Corrosion et Anticorrosion,* v. 8, no. 5, May 1960, p. 177-184.

10556 Production and Demonstration of Atomically Clean Metal Surfaces. Solid surfaces of the metal W have been cleaned by ion bombardment. The phenomenon used in this work to observe surface conditions during the cleaning procedures is the Auger-type ejection of electrons by slowly moving positive ions. ***H. D. Hagstrum and C. D'Amico.*** *Journal of Applied Physics,* v. 31, Apr. 1960, p. 715-723.

10557* Acid Dip Concentration Control. Presents a formula by which specific gravity may be related to per cent by volume. ***G. N. Mandel.*** *Metal Finishing,* v. 58, May 1960, p. 56-58.

10558 Ultrasonic Cleaning. Frequencies recommended for cleaning range from 18 kc to about one megacycle. Generally, lower frequencies in the ultrasonic range are more effective, but those below 20 kc produce such a squeal that the cleaning equipment must be enclosed to prevent human discomfort. ***Paul W. Steen.*** *Metal Industry,* v. 96, Apr. 29, 1960, p. 355-357.

10559* Surface Cleaning and Surface Treatment. The design of mechanical washing and degreasing plant, and of ultrasonic equipment, tends to include automation which will result in a saving of labor and eliminate the difficulties resulting from manual operations which are often unreliable. Similar trends, designed to achieve further perfection of the automatic operating cycle, were also noted in electroplating equipment. *Wire,* no. 46, Apr. 1960, p. 35-39.

METALS—FOUNDRY PRACTICE

10560 A Practical Application of Nucleation Theory to Soundness in Iron Castings. The causes of internal porosity in clutch plate castings produced in a foundry using an iron approximating Grade 17 of B.S. 1452:1956 were investigated. Deals with the influence of ladle inoculation and pouring temperature; describes an additional investigation into variations in the cupola operation and their effects on metal characteristics. ***J. D. Berry, J. M. Greenhill, and K. E. L. Nicholas.*** *B.C.I.R.A. Journal of Research and Development,* v. 8, no. 3, May 1960, p. 377-392.

10561* Foundry Floor Practice. Deals with the manufacture of a few odd size pipe specials on "One Off" lines. The manufacture of these castings was carried out with the available plant and tackle in the shop and the pattern equipment. ***S. G. Athanikar.*** *Current Engineering Practice,* v. 2, no. 9, Mar. 1960, p. 44-49.

10562* Development in the Technique of Using Liquid Fuels in the Martin Furnace. A study covering heat transmission in the open hearth furnace and some constructive and functional criterions of the burner. (*In Italian.*) Sviluppi nella tecnica dell'uso dei combustibili liquidi nei forni martin. ***F. Mastrorazio and M. Scotto.*** *Fonderia,* v. 9, Apr. 1960, p. 131-133.

10563* pH, a New Factor for Controlling Molding Sands. A control method of the scab defect appearing on gray iron castings and steel castings when molding sand is intensively used after a long shutdown consists in measuring the acidity or basicity (alkalinity) of the sand mixture. The raise of the pH value by adding alkaline products to the return sand gives entirely satisfactory results. (*In French.*) Le pH, nouveau facteur de contrôle des sables de moulage. ***J. Castells.*** *Fonderie Belge*, v. 30, no. 5, Apr. 1960, p. 141-146.

10564 Die Design Improves Zinc Diecastings. Impact strength of zinc diecastings is discussed in relationship to features of die designs planned to produce optimum quality. This article includes a resume of composition limits in zinc diecastings. ***George L. Werley.*** *Foundry*, v. 88, June 1960, p. 109-115.

10565 Inoculants for Production of High-Strength Gray Iron. A concise treatment of the important subject of inoculation, including information on its purposes, types of inoculants available, and how to use the technique successfully in your foundry. ***Howard H. Wilder.*** *Foundry*, v. 88, June 1960, p. 116-119.

10566 Punched Card Data Help Improve Casting Quality. The use of data processing machines provides foundrymen with another tool for improving effectiveness of their operation. Here's one foundry's experience with this modern production tool. ***Robert H. Herrmann.*** *Foundry*, v. 88, June 1960, p. 120-123.

10567 Gating Systems for the Steel Foundry. Gates and casting quality; causes of mold erosion; effect of gating on porosity; gas effects on mold surface. ***Charles W. Briggs.*** *Foundry*, v. 88, June 1960, p. 124-127.

10568 Dimensional Aspects of Lost-Wax Investment Casting. Concerned mainly with the why's and wherefore's of the fact that, whereas the lost-wax investment-casting process is often claimed to be accurate to ±0.005 in., this tolerance is sometimes not achieved. ***R. Taylor and N. Mason.*** *Foundry Trade Journal*, v. 108, June 2, 1960, p. 696-700.

10569* Selection and Application of Parting Agents and Lubricants for Dies and of Hydraulic Fluids in the Pressure Die Casting Foundry. Requirements for die parting agents; spraying by means of a gun; characteristic features of die lubricants; lubricants for moving parts of die-casting machines and dies; hydraulic fluids. (*In German.*) Auswahl und Anwendung von Formentrenn- und Schmiermitteln sowie Hydraulikmedien in der Druckgiesserei. ***Willy Flick.*** *Giesserei*, v. 47, no. 9, May 5, 1960, p. 241-244.

10570* Setting Dimensions in Chill Mold Casting. Calculation of setting dimensions is discussed. (*In Russian.*) Posadochyne razmery sterzhneĭ dlia kokil'nogo lit'ia. ***D. S. Soskin.*** *Liteĭnoe Proizvodstvo*, 1960, no. 5, May, p. 4-6.

10571* Investment Casting in Vacuum. Some Experiences. Considers types of equipment available to the investment founder, advantages and defects arising from the vacuum technique, and application trends. ***L. S. Taylor.*** *Machinery (London)*, v. 96, June 1, 1960, p. 1249-1253.

10572* Decreasing the Sulfur Content in Cast Iron. Introducing more efficient reducing agents, such as Al, Ti, calcium carbide, etc., into the furnace improves the reduction of ferrous oxide and guarantees the passages of S into the slag. When Al was introduced, the following reaction was obtained $(FeO) + Al = [Fe] + (Al_2O_3) + 329270$ cal. Thus, the increase in the temperature of the slag and the full reduction of Fe explain the improvement in the desulfurizing process. (*In Russian.*) O snizhenii soderzhaniia sery v chugune. ***A. A. Gimmel'farb.*** *Metallurg*, v. 5, no. 5, May 1960, p. 6-8.

10573* The Vibrating Ladle in the Desulphurization and Alloying of Cast Iron Melts. Units for accelerating metallurgical reactions and ensuring close contact between lime and cast iron by means of a vibrating ladle. Description of the plant in service at the Mannesmann-Meer Iron Works. A study of the mechanism of desulfurization. Advantages and applications of the process. (*In French.*) La poche à secousses dans la désulfuration et l'alliage des coulées de fonte. ***S. Tunder.*** *Metallurgie et la Construction Mécanique*, v. 92, May 1960, p. 317-328.

10574* Aluminum Melting Practices for Permanent Mold and Die Casting. High on the list is selection of proper furnace with proper temperature-control devices. A common source of difficulty lies in pouring permanent mold castings too hot and die castings too cold. In one case critical elements burn out and in the other they sludge out. As metal temperatures rise so does H absorption. Fatal to casting quality is a small dose of Mg containing scrap in an Al-Si alloy melt and vice versa. ***Walter Bonsack.*** *Modern Castings*, v. 37, June 1960, p. 44-47.

10575* Ramming and Clay Content Effect on Hot Compression Strength of Molding Sand. Shows that increased ramming can raise hot compressive strength of any sand mixture by about 4-10 times, depending on temperature of testing. Fire clay does not display an optimum clay content for maximum hot compressive strength as do the bentonites. Iron foundry sands containing carbonaceous additives have much lower hot strength than equivalent simple sand-clay mixtures. ***R. W. Heine, J. S. Schumacher, W. F. Shaw, and E. H. King.*** *Modern Castings*, v. 37, June 1960, p. 90-97.

10576 An Improved Pattern Investing Method. A gas fluidized bed of investment material makes building up an investment casting mold faster, better and easier. ***F. C. Quigley and Eugene Deluca.*** *Precision Metal Molding*, v. 18, June 1960, p. 31.

10577 The Break Even Point in Investment Castings. A few general rules to apply as a first approximation in determining whether or not investment casting is the most economical manufacturing method. ***William C. Miller.*** *Precision Metal Molding*, v. 18, June 1960, p. 32-34.

10578* The Production of Part-Chill Rolls From Spheroidal Graphite Cast Iron. The cast iron, with 0.4-0.6% Cr and 1.2-1.8% Ni addition, is melted in an electric arc furnace with 8 tons capacity. A 0.54% quantity of Mg is added under bells. Part-chill rolls of spheroidal graphite cast iron withstand the passing of 34-40 thousand tons of rolled billets as compared with 20-25 thousand tons which were obtained with grey cast iron rolls. To increase the strength of the rolls the C content may be reduced to 2.0-2.1% C. Instead of Ni content the Si content may be increased up to 2.0-2.2% Si, and that of Mn up to 0.9-1.1% Mn with a Cr content of 0.45-0.55% Cr. (*In Polish.*) Nowa konstrukcja grzejnika centralnego ogrzewania w swietle wskaznikow techniczo-ekonomicznych. ***Mieczysław Nader.*** *Przeglad Odlewnictwa*, v. 10, no. 4, Apr. 1960, p. 106-111.

10579 Variation in the Chemical Composition of White Cast Iron During Melting in the Cupola. The C and Si contents are chosen so that the position of cast iron composition in the constitutional diagram are in the zone of solidification of white cast iron and in the neighborhood of the curve marking the zone of white and of mottled cast irons. Melting specifications for the reduction of variation of chemical composition were elaborated. It is possible to reduce considerably the variation of chemical composition during melting. (*In Czech.*) Kolísání chemického složení bílé litiny při tavení v kuplovně. ***Zdeněk Hostinský.*** *Slévárenství*, v. 7, no. 5, May 1960, p. 181-188.

See also: **10681** (shape of graphitic carbon in malleable cast iron).

METALS—HEAT TREATMENT

10580* Heat Treatment of Uranium. A U quenching process producing a fine grained and quasi-isotropic structure is described. The strength properties of U can be increased by quenching from β- to γ-phases. The effects of quenching on the fine and the coarse grain as a function of the chemical composition are shown and the creep of U within the range of temperatures and the α-phase is investigated. (*In Russian.*) Termicheskaia obrabotka urana. ***G. Iu. Sergeev, V. V. Titova, Z. P. Nikolaeva, and A. M. Kapel'tsev.*** *Atomnaia Energiia*, v. 8, no. 4, Apr. 1960, p. 340-347.

10581 New Heat-Treating Process. A new Tricarb heat-treating process, developed by the Leeds & Northup Company of Philadelphia, can be used interchangeably for homogeneous

carburizing, controlled case carburizing, carbon restoration, hardening or carbonitriding. *Iron & Steel*, v. 33, no. 5, May 1960, p. 184.

10582* Protection Against Decarbonization During High Speed Steel Annealing. Such annealing in a protective gas medium obtained by partial burning of kerosene with additional purification from CO_2 and H_2O prevents superficial decarburizing and skin formation. The metal should be heated to 900 C. The thermal treatment conditions in the protective medium are very important during the production of a thin section wire from high-speed steel. (*In Russian.*) Zashchita ot obezuglerozhivaniia pri otzhige bystrorezhyshcheĭ stali. ***D. A. Teĭmer, A. G. Petrenko, and L. A. Kurtova.*** *Metallovedenie i Termicheskaia Obrabotka Metallov*, 1960, no. 5, May, p. 19-23.

10583* Press Quenching Under Exact Control. Press quenching of crown wheels and other gearing at the Ford Motor Co. Ltd. is now being carried out under the control of Radiamatic equipment supplied by Honeywell Controls Ltd. The method makes use of the heat radiated by the component to initiate and control the full operating cycle of the Gleason quench presses to ensure distortion-free gears. *Metalworking Production*, v. 104, no. 22, June 1, 1960, p. 988-989.

10584* Graphitization of Spheroidal Cast Iron During Tempering. For a systematic study of processes occurring during tempering of quenched spheroidal cast iron, metallographic and dilatometric methods, the method of differential thermal analysis, and the roentgenographic method were used; in some cases mechanical properties such as hardness and notch toughness were studied. The study proved that at lower tempering temperatures the tempering of spheroidal cast iron is similar to the tempering of silicon steels. (*In Czech.*) Grafitisace tvárné litiny při popouštění. ***Ryš Přemysl. Slévárenství***, v. 7, no. 4, Apr. 1960, p. 141-148.

10585 Spheres of Application of High Vacuum Annealing Plants in Steel Drawing and Cold Rolling Mills. Annealing under vacuum at 600 C removes all discolorations, at 700° even the rust is dissociated. Descaling under vacuum without reducing agents is applied with success for carbon and Cr-Ni steels. ***Werner Herdieckerhoff.*** *Wire Industry*, v. 27, May 1960, p. 469 + 4 pages.

See also: **10628** (annealing of Mg cast iron).

METALS—MECHANICAL AND PHYSICAL PROPERTIES

10586 Relations Between the Notch Tensile Strength of Cylindrical and Prismatic Specimens of Titanium Alloys and Heat-Treated Steels. Notch tensile strengths were determined, at room temperature, for 4340 steel heat-treated to various strength levels, and for the titanium alloys 6Al-4V and 5Al-1.5Fe-1.4Cr-1.2Mo(Ti-155A). ***G. Sachs, J. G. Sessler, R. F. Pray, and T. H. Yeh.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 401-410.

10587 Nonmetallic Inclusions and Fracture Behavior of Steels. Some observations showing the adverse effects of certain kinds of nonmetallic inclusions on the strength and fracture behavior of alloy steel test specimens are presented. ***S. Yukawa.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 411-416.

10588 Fracture Mode Transition for a Crack Traversing a Plate. The usually observed abrupt change from brittle to ductile fracture with increase of temperature as well as the less commonly studied change of fracture mode with plate thickness can be ascribed to the unstable growth tendency of the plastic zone at the leading edge of the crack. ***G. R. Irwin.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 417-425.

10589 Effect of Relaxation on the Behavior of Materials Under Combined Alternating and Static Stress. The effect of temperature on the stress range diagram is discussed and the particular characteristics of the curves for unnotched and notched specimens are analyzed. Excluding metallurgical factors from consideration, it is suggested that relaxation is the principal mechanism which influences the behavior of polycrystalline metals under combined alternating and static stress. ***F. H. Vitovec.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 441-446.

10590 Creep Rupture Tests for Design of High-Pressure Steam Equipment. Creep rupture tests on tubular specimens of type 316 stainless steel were run at 1200 F and at pressures up to 24,000 psi. The specimens were tested under pure internal pressure and equal biaxial tensions. ***E. A. Davis.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 453-461.

10591 Steady Creep of a Tube Under Combined Bending and Internal Pressure. It is shown that for a tube in bending the steady-state creep rate may be greatly increased by the addition of internal pressure. If the maximum bending stress is small compared to the pressure stress, a very simple expression is obtained for the ratio of bending creep rates. ***Iain Finnie.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 462-464.

10592 Effect of Wall Thickness on Stress-Rupture Life of Tubular Specimens. Stress-rupture data obtained from tubular specimens stressed with internal pressure are compared with data from standard tension-bar specimens from the same heats of material. Agreement between the data of the two types of specimens is poor for thick-wall tubes when the hoop stress in the tube wall is calculated on an average stress basis. ***J. T. Tucker, Jr., E. E. Coulter, and L. F. Kooistra.*** *ASME, Transactions, Series D, Journal of Basic Enigneering*, v. 82, no. 2, June 1960, p. 465-476.

10593 Dislocation Damping in Metals. Internal friction in metals, the Bordoni peak, amplitude-dependent internal friction at low and medium temperatures, internal friction at high temperatures, and amplitude-independent internal friction at low strain amplitudes are discussed. ***D. H. Niblett and J. Wilks.*** *Advances in Physics*, v. 9, no. 33, Jan. 1960, p. 1-88.

10594 The Tensile Fracture of Ductile Metals. Ductile fracture of polycrystalline metals in tension is initiated by the formation of voids approximately at the strain at which necking begins. In OFHC copper, heat treated in H, these are intergranular; when heat treated in vacuo or dry N the majority are with the grains. These voids grow with increasing strain in the region of the neck. With further strain the voids coalesce to form a crack at the center of the neck. Crack growth takes place by the concentration of strain at the tip of the static crack in two thin sheets at an angle of approximately 30 deg to the tension axis. Numerous small voids form in these deformed regions, weakening them so that one fails under tension. This then extends the crack both radially and out of the plane of maximum tensile stress. The extended crack once again concentrates strain at its tip with subsequent "void sheet" formation and failure. However, this time the failure is such as to propagate the crack back through the plane of maximum tensile stress. If the crack propagates to the specimen surface by such a mechanism the result is a "cupcone" fracture such as found for Fe, brass, and duralumin. In such fcc metals as Au, Ag, Cu, Al, and Ni the final separation takes place by a different mechanism: either "ductile cleavage" or an "alternating slip" mechanism. The result is a "double-cup" fracture. ***H. C. Rogers.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 3, June 1960, p. 498-506.

10595 Effect of Gage on Rockwell Hardness Testing of Brass Strip. The minimum thickness of strip that can be tested safely for Rockwell hardness has long been controversial. Tests indicated to some extent an effect of specimen thickness on the measured hardness values; large scatter of the plotted data rendered the results inconclusive. In an attempt to minimize this scatter, the Scovill Manufacturing Co. has recently completed studies on brass strip. This paper reviews and interprets the tabulated test results and makes recommendations for changes in strip specifications. ***Delmar E. Trout.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 212-229, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10596 Magnetic Properties of Copper Alloys. Magnetic susceptibility and permeability were determined for 26 commercial copper alloys, in at least two different tempers. Also 13 commonly used copper alloys were made up experimentally with the maximum allowable iron content and then heat treated and worked so as to produce maximum properties. Permeability and susceptibility were also determined for 6 aluminum bronzes. ***F. G. Parker, R. M. Winter, and J. A. LaPorta.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 230-261, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10597 The Effect of Stress Cycling on the Static Mechanical Properties of SAE 4340 Steel. Precycling produced small changes in the properties: it reduced the hardness and ductility but increased the ultimate strength and the strain hardening exponent. ***J. Marin, P. Borachia, and U. A. Rimrott.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 662-676, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10598 Some Observations on the Plastic Work Required to Fracture Stainless Steel Under Cyclic Loading. Controlled-load, low-cycle, axial fatigue tests were conducted on AISI Type 347 stainless steel at 1000 F. Periodic records of the stress-strain behavior of the specimens were obtained by means of an oscilloscope camera. The results are analyzed in terms of the plastic strain per cycle and the total plastic work required to fracture the specimens. ***D. E. Martin and J. Brinn.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 677-690, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10599 Techniques and Equipment for Fatigue Testing at Very High Frequencies. A description is given of resonant ultrasonic vibrators used recently in high-frequency fatigue testing. Fatigue limits of metals at high frequency are rarely identical with those measured at low frequency; discrepancies up to 40% have been observed for light alloys, steels and brasses. At high frequency, precautions must be taken to avoid overheating; suitable techniques are described. ***E. A. Neppiras.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 691-710, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10600 A Method for Determining the Fatigue Limit of Metals by Means of Stepwise Load Increase Test. A method is proposed for determining the fatigue limit by a fatigue test under stepwise increasing load with only one loading rate. The practicability of the method is appraised. ***N. Enomoto.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 711-722, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10601 Effect of Internal Heating on the Fatigue Life of Titanium. A continuous time record of temperature and deflection was obtained during fatigue tests of specimens under isothermal and nonisothermal conditions. ***J. P. Romualdi and E. D'Appolonia.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 723-733, 1960, American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10602 Crack Propagation in Cold-Rolled Aluminum Sheet. Low-cycle, high-stress fatigue tests in fluctuating tension were performed on transverse and longitudinal specimens of sheet 1100-H18 aluminum alloy. The data indicate that the growth of a fatigue crack is not linear in these tests, or even continuous. ***H. A. Lipsitt, F. W. Forbes, and R. B. Baird.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 734-754, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10603 Fatigue Tests on Three Cast Irons at Elevated Temperatures. Direct stress fatigue tests are conducted on three cast irons: meehanite, Ni-Mo, and nodular iron. Pulsating fatigue tests were performed on all three materials, and completely reversed push-pull tests were conducted on Ni-Mo and nodular iron. In pulsating fatigue at 900 F, nodular iron is stronger than meehanite or Ni-Mo iron for 10^7 cycles. ***R. P. Felgar.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 767-773, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10604 Experimental Determination of Energy Release Rate for Notch Bending and Notch Tension. Values of energy release rate were determined experimentally, as a function of notch depth, for notch bending and notch tension; and by means of fracture tests the critical energy release rate was determined for two steels. ***J. D. Lubahn.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 885-915, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10605 Behavior of Ductile Cast Iron Under Compressive Stress. Compression specimens were machined from ½, 1, and 2 in. "Y" blocks, austenitized and quenched from 1600 F and tempered 1 hr at 1300, 1150, 925, and 300 F. The compression modulus did indicate some sensitivity to the less perfect graphite spheroids present in the 1-, and 2-in. sections. ***Paul K. Trojan, R. A. Flinn, and D. J. Reese.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 922-929, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10606 Effect of Environment on Creep and Creep-Rupture Behavior of Several Steels at Temperatures of 1000 to 1200 F. Properties of ferritic and austenitic stainless steels were determined from tests in air, in a purified mixture of helium plus 2% hydrogen, and in vacuum at 1000 to 1200 F. The results indicate that the creep and creep-rupture properties are not affected by environment within the limits of the experiments performed. ***F. Garofalo.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 973-984, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10607 Effect of Notch Geometry on Tensile Properties of Annealed Titanium at 100, 25, —78, and —196 C. True stress-true strain data were obtained to the initiation of the fracture of specimens at 100, 25, −78, and −196 C, and representative true stress-true strain curves are presented. ***G. W. Geil and N. L. Carwile.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 985-1014, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10608 Stress-Strain Properties of Selected Titanium Metals. The plastic flow properties of three titanium metals as function of four strain rates and five temperature levels were studied. ***E. P. Klier and C. P. Gazzara.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 1015-1034, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10609 Properties of 70-30 Copper-Nickel Alloy at Temperatures Ranging up to 1050 F. Some physical and mechanical properties for Cufenloy 30, a wrought 70.0 copper, 20.1 nickel, 0.5 iron, and 0.35% manganese alloy, in the drawn and stress-relieved temper are given at elevated temperatures. The physical properties include thermal expansion, thermal conductivity, electrical resistivity and conductivity, and dynamic modulus of elasticity. This alloy has the proper combination of strength properties, ductility, and stress-corrosion resistance to make its use advantageous for unfired pressure vessel applications at temperatures up to 850-900 F. ***W. F. Simmons, B. J. Sirois, D. N. Williams, and R. I. Jaffee.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 1035-1051, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10610 The Tensile Properties of Some Engineering Materials at High Rates of Strain. An experimental method to determine the dynamic tensile properties of materials at high rates of strain was developed. An explosive-impact tension tester which has provisions for direct measurements of load, impact velocity, and instantaneous changes of diameter as a function of time is used. ***Arthur L. Austin and Robert F. Steidel, Jr.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 1272-1308, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10611* Susceptibility Measurements of Nb Between Room Temperature and Liquid Helium Temperatures. The susceptibility shows an increase of 1% per 100° for decreasing temperatures. No field dependence could be detected up to liquid hydrogen temperature. ***A. Van Itterbeek, W. Peelaers, and***

F. Steffens. Applied Scientific Research, Sec. B, Electrophysics, Acoustics, Optics, Mathematical Methods, v. 8, no. 3, 1960, p. 177-182.

10612* Relationship Between Internal Stresses, Volume Changes and Structure in Hot Bath Hardening of Steel. A study of the total volume change and Rockwell hardness of various steels after quenching in a hot bath and tempering to 215 C, and of the strength, magnetic saturation, and remanence of bars separated from the plates after hot treatment. (*In German.*) Zusammenhang zwischen inneren Spannungen, Massänderungen und Gefüge bei der Warmbadhärtung von Stahl. ***Heinz Borchers and Anton Safferling.*** *Archiv für das Eisenhüttenwesen*, v. 31, no. 5, May 1960, p. 291-297.

10613* Changes of Internal Friction With Temperature for Polycrystalline Uranium. Polycrystalline U specimens quenched from the γ phase, tempered in the γ and α phases and recrystallized were studied. The speed in the increase of the internal friction of a specimen with time gradually decreases. This increase reaches a limit value somewhat proportional to the speed of heating of the specimen. It is connected with the stresses occurring in the specimen during the change of temperature on account of the anisotropy of the coefficient of thermal expansion. (*In Russian.*) Issledovanie uvelicheniia vnutrennego treniia v obraztsakh polikristallicheskogo urana pri izmenenii temperatury. ***Iu. N. Sokurskii and Iu. V. Bobkov.*** *Atomnaia Energiia*, v. 8, no. 4, Apr. 1960, p. 348-353.

10614 The Ductility of Nodular Cast Irons as Revealed by the Impact Test. It is shown that in order to obtain ductile materials at room temperature capable of withstanding shock loading conditions, the Si, Mn, P, and to a lesser extent, Ni contents must be controlled within reasonable limits. ***G. N. J. Gilbert.*** *B.C.I.R.A. Journal of Research and Development*, v. 8, no. 3, May 1960, p. 401-421.

10615 Influence of Residual Stresses on Fatigue Strength of Plates With Fillet Welded Attachments. The report contains details of various fatigue tests carried out to confirm that the increase in strength obtainable by spot heating certain types of notched specimen is due to the residual stresses so induced. It has also been shown that similar increases in strength can be obtained by inducing residual stresses by mechanical means. ***T. R. Gurney.*** *British Welding Journal*, v. 7, June 1960, p. 415-431.

10616* Why Cobalt for Magnetic Development. It can be safely stated, in the light of present-day knowledge, that it should generally be possible to develop a specific magnetic material for each technical application, and that cobalt should play an important role in such developments. ***Edgar Ascher and Aloysio Janner.*** *Cobalt*, no. 7, June 1960, p. 3-5.

10617* Contribution to the Magnetic Properties of Some B8-Type Phases. Shows that the Curie law does no hold for the compounds CoSb, NiSb, NiTe, etc., which are characterized by a small number of uncompensated 3d-electrons in the T-metal, and a high valency electron concentration in the B-metal. ***Hans Schmid.*** *Cobalt*, no. 7, June 1960, p. 26-32.

10618* Magnetic Resonance in Sodium Alloys. The paramagnetic resonance in conductivity electrons in N-Cs alloys was investigated at frequencies of 300 and 9430 megacycles, T = 295 and 90 K. The relationship with the composition of the Knight displacement of the line of the nuclear resonance of Na^{23} in Na-K, Na-Cs and Na-Hg alloys was studied. (*In Russian.*) Magnitnyĭ rezonans v splavakh natriia. ***N. S. Garif'ianov and A. V. Il'iasov.*** *Fizika Metallov i Metallovedenie*, v. 9, no. 4, Apr. 1960, p. 503-506.

10619* Contribution to the Study of Hardness Testing of Cast Iron by Means of the Hardness Tester as Developed by Poldi-Hütte. Tests were made with the Poldi apparatus on 33 cast-iron samples. Results were compared with data obtained with the Brinell tester. Scatter ranges are determined. (*In German.*) Zur Härteprüfung von Gusseisen mit dem Härteprüfer der Poldi-Hütte. ***Franz Hickel.*** *Giesserei*, v. 47, no. 10, May 19, 1960, p. 273-276.

10620* Behavior of Malleable Cast Iron When Stressed Under Shock. Measurements based on mathematical and statistical methods revealed that the shock stress capacity of malleable cast iron is definitely influenced by the alloy composition (Si, Mn - S ratio) and the structural formation (amount of perlite, amount and form of temper carbon). (*In German.*) Das Verhalten von Temperguss bei Schlagbeanspruchung. ***Karl Löhberg and Hans Günter Trapp.*** *Giesserei*, v. 47, no. 11, June 2, 1960, p. 283-287.

10621 Low-Temperature Recovery of Ductility in a Hydrogen-Embrittled Alpha/Beta Titanium Alloy. Tensile tests performed at various temperatures, strain rates, and H levels allowed an activation energy to be calculated for the embrittlement process in H-containing Ti-2% Fe-2% Cr-2% Mo alloy. The activation energy based on the recovery of ductility at low temperatures is similar to that for diffusion of H in unalloyed β-titanium. Thus, it was concluded that the recovery of ductility is a rate-controlled process related to the diffusion of H in the β phase of the two-phase alloy. ***F. R. Schwartzberg, D. N. Williams, and R. I. Jaffee.*** *Institute of Metals, Journal*, v. 88, pt. 8, Apr. 1960, p. 352-356.

10622 Embrittlement of a 12%Cr-4%Ni Steel. The extent to which a complex 12%Cr-4%Ni steel can be embrittled by heat-treatment was examined. Heating in the temperature range 250-550 C produces a considerable increase in hardness and loss of room temperature impact strength. Heating around 680 C before applying a lower temperature treatment delays the onset of embrittlement. ***G. T. Brown and R. T. Allsop.*** *Iron and Steel Institute, Journal*, v. 194, pt. 4, Apr. 1960, p. 435-442.

10623* Modulus of Elasticity of Alkali-Halide and Metallic Alloys. Test in measuring the Young modulus in single crystals of alkali-halide salts and their solid solutions revealed that in the NaBr-KBr, NaBr-NaCl, and KBr-KCi systems, the Young modulus-composition diagrams are smooth curves yielding a negative nonadditivity. In determining the values of the Young modulus of the metallic systems Pb-Sn, Pb-Sb, Sn-Cd, Sn-Bi, Cd-Zn and Cd-Bi, it was found that the eutectic composition of the Cd-Zn and Bi-Cd systems is characterized by the highest deviation of the value of the Young modulus from the additive value. (*In Russian.*) Modul' uprugosti shchelochnogaloidnykh i metallicheskikh splavov. ***P. A. Savintsev and A. A. Botaki.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Fizika*, 1960, no. 1, p. 68-72.

10624 X-Ray Examination of Brittle Fractures in Extruded Chromium. Estimates of the amount of deformation present at the fracture surfaces showed that very large plastic strains were associated with brittle cleavage fracture at the higher temperatures, such that the length of a self-sustaining crack calculated according to the modified Griffith crack formula of Hall, was more than an order greater than the mean grain diameter of the material. ***C. W. Weaver and K. A. Gross.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 626-631.

10625 Elastic Constants of Yttrium Single Crystals in the Temperature Range 4.2-400°K. The five independent elastic constants for Y single crystals were determined by the pulse-echo technique. The experimental values extrapolated to 0 K are: $C_{11} = 8.34 \pm 0.02$, $C_{33} = 8.01 \pm 0.02$, $C_{44} = 2.690 \pm 0.006$, $C_{12} = 2.91 \pm 0.03$, and $C_{13} = 19 \pm 0.4$ in units of 10^{11} d/cm^2. The degree of elastic anisotropy is low throughout the entire temperature range. ***J. F. Smith and J. A. Gjevre.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 645-647.

10626 Temperature-Dependence of the Electrical Resistivity of bcc Cr-Fe Alloys. The absence of any discontinuity in this curve indicates that the very high temperature-coefficient of the linear term of the specific heat previously found at that composition is not associated with a phase transformation between room temperature and 4.2 K. For bcc Cr-alloys with Fe contents increasing from 0 to 16 at.% Fe, the resistivity vs. temperature anomaly shifts from approximately 308 K to progressively lower temperatures, and the anomalous resistivity increase with decreasing temperature becomes progressively larger. ***N. S. Rajan, R. M. Waterstrat, and Paul A. Beck.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 731-732.

10627* A Simple Model of a Propagating Crack. A model of a crack is developed in which the surface energy in the Griffith treatment is taken to depend on the temperature and strain rate. It is shown that such a crack shows a transition from brittle to ductile behavior as the temperature is raised. ***A. N. Stroh.*** *Journal of the Mechanics and Physics of Solids*, v. 8, no. 2, May 1960, p. 119-122.

10628* Effect of the Method of Annealing Magnesium Cast Iron on Its Mechanical Properties. The plastic properties of magnesium cast iron increase with the increase of the time of annealing, but the hardness and stability drop a little. The mechanical properties of magnesium cast iron get stabilized after a sufficiently long endurance of the homogenizing annealing. (*In Russian.*) Vliianie rezhima otzhiga magnievogo chuguna na ego mekhanicheskie svoĭstva. ***K. I. Yashchenko, R. P. Todorov, and G. I. Koshovnik.*** *Liteĭnoe Proizvodstvo,* 1960, no. 5, May, p. 28-29.

10629* The Hardness of Cementite. The experimental results showed that the quenching of hyeutectic and of eutectic white iron does not change the average microhardness. The isothermal soaking in the range of 300-700° also does not change the microhardness of cementite. (*In Russian.*) O tverdosti tsementita. ***I. N. Bogachev and S. B. Rozhkova.*** *Liteĭnoe Proizvodstvo,* 1960, no. 5, May, p. 34-36.

10630* Decrease in the Deformation of Billets and Parts of Alloy B95 During Hardening. In order to decrease warping in the case considered the following thermal treatment conditions were recommended: preliminary anodizing of the surfaces, 5 to 50 mk deep; heating during hardening to 465-480 C; cooling of the parts in water at 80-85 C; aging at 135-145 C during 16 hours; removal of the anodic coating. (*In Russian.*) Umen'shenie deformatsii zagotovok i detaleĭ iz splava B95 pri zakalke. ***V. D. Bessonov, E. S. Kozochkina, and G. K. Soboleva.*** *Metallovedenie i Termicheskaia Obrabotka Metallov,* 1960, no. 5, May, p. 11-15.

10631 Some Factors Affecting the Intergranular Brittleness of Internally Oxidised Alloys. Tensile tests were carried out on Cu dispersion-hardened by internal oxidation. The intergranular brittleness (associated with intense grain boundary precipitates) was eliminated when specimens were prepared by recrystallization of internally oxidized single crystals. ***R. H. Seebohm and J. W. Martin.*** *Metallurgia,* v. 61, May 1960, p. 201-203.

10632* Analytical Approach to the Study of the Effect of Small Cavities on Fatigue Strengh. The main variables to be considered are: shape of cavity, orientation of cavity with respect to stress, proximity of cavities to each other, absolute size of cavity, and material containing the cavity. ***R. E. Peterson.*** *Nondestructive Testing,* v. 18, no. 3, May-June, 1960, p. 193 + 2 pages.

10633 The de Haas-van Alphen Effect in Copper, Silver and Gold. Measurements suggest strongly that the Fermi surfaces of these metals make contact with the hexagonal faces of the Brillouin zone. The areas of cross section of the main part part of the Fermi surface and of the contact were determined. ***D. Shoenberg.*** *Philosophical Magazine,* v. 5, ser. 8, Feb. 1960, p. 105-110.

10634 Magnetoresistance of Copper, Silver and Gold. Magnetoresistance measurements of Alekseevskii and Gaidukov on single crystals of Cu, Ag and Au are consistent with the Fermi surfaces of these metals proposed on the basis of anomalous skin effect and de Haas-van Alphen effect measurements. ***M. G. Priestley.*** *Philosophical Magazine,* v. 5, ser. 8, Feb. 1960, p. 111-114.

10635 The g-Factor and de Haas-Van Alphen Effect of Electrons in Bismuth. A theory of the g-factor of conduction electrons is developed which is valid for low symmetry and arbitrary strength of spin-orbit coupling. Application to Bi shows that $m_s \equiv 2/g \simeq m_0$ for most orientations, where m_0 is the effective mass entering the cyclotron frequency. Thus g is 260 where $|-|$ is in the direction of smallest m_0. ***M. H. Cohen and E. I. Blount.*** *Philosophical Magazine,* v. 5, ser. 8, Feb. 1960, p. 115-126.

10636 The Effect of Internal Oxidation on the Damping Capacity of Copper-Silicon Alloys. Damping capacity measurements were carried out on specimens before and after internal oxidation and the results compared with those for O free, high conductivity Cu specimens given the same treatment. High damping values were noted for the fully internally oxidized Cu-Si material. ***T. B. Gibbons and S. O'Hara.*** *Philosophical Magazine,* v. 5, ser. 8, Feb. 1960, p. 140-145.

10637 Low-Temperature Internal Friction in Face-Centered Cubic and Body-Centered Cubic Metals. Data on the anelasticity produced by plastic deformation in various face-centered cubic and body-centered cubic pure metals and alloys are reported. Fcc materials studied at temperatures from 4.2 to 300 K include Cu, Al, and Al-0.25 at.% Cu. Bcc systems included Fe, Nb, and β brass. Bordoni peaks were observed in Cu and Al. ***L. J. Bruner.*** *Physical Review,* v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 399-410.

10638 Thermoelectric Power of Dilute Copper Alloys. The thermoelectric power of dilute binary Cu alloys containing one at.% Zn, Ge, Cd, In, Sn, and Sb was determined over the temperature range extending from about 8 to 320 K. The thermoelectric powers were obtained by measuring the thermoelectric emf's of thermocouples emf's of thermocouples formed of the alloys and pure Cu. ***F. J. Blatt and R. H. Kropschot.*** *Physical Review,* v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 480-489.

10639 Nuclear Quadrupole and Electronic Heat Capacities of Bismuth. The heat capacity of Bi was measured from 0.1 to 2.0 K and found to be represented by $C = 2.8 \times 10^{-7}\ T^{-2} + 2.1 \times 10^{-5}\ T + 1944\ (T/\Theta)^3$ joules/mole deg with $\Theta = 120.4 - 0.67^2$. The T^{-2} term in the heat capacity is assumed to be associated with the alignment of the nuclear electric quadrupole moment in the electric field gradient of the crystal and is used to obtain the value 25 Mc/sec for the quadrupole coupling constant. ***Norman E. Phillips.*** *Physical Review,* v. 118, 2nd ser., no. 3, May 1, 1960, p. 644-647.

10640 Influence of Cold Work on the Resistivity of Dilute Copper Alloys. Measurements are reported of the residual electrical resistivity of a Cu plus 1 at.% Sb alloy which had been cast and rolled. A large increase was observed on annealing. ***P. G. Klemens, R. J. Tainsh, and G. K. White.*** *Physical Review,* v. 118, 2nd ser., no. 3, May 1, 1960, p. 654-655.

10641 Optical Constants of Aluminium. The optical constants of Al from the near ultra-violet (2500 Å) to the near infra-red (5μ) can be described, at least qualitatively, in terms of the Drude formula by the two parameters N and τ, the density of free electrons and the relaxation time, respectively. ***H. Mendlowitz.*** *Physical Society, Proceedings,* v. 75, pt. 5, May 1960, p. 664-670.

10642* Effects of Impurities on the Electric Conductivity of Copper. Based on the most recent research work regarding the reaction of the conductivity of Cu, diagrams were compiled, which illustrate the influence of metallic and nonmetallic admixtures to a concentration up to 0.10% regarding the electric resistance and electric conductivity. These diagrams are based upon the increases of resistance according to F. Pawlek and assistants, also upon a maximum conductivity of the purest Cu of 60 S·m/mm². (*In German.*) Einfluss von Beimengungen auf die elektrische Leitfähigkeit von Kupfer. ***E. Brunhuber.*** *Radex Rundschau,* 1960, no. 2, Apr., p. 104-107.

10643* Effect of Tempering on the Thermal Diffusivity of Carbon Steel. Under the effect of tempering the temperature conductivity of low carbon steel St 15 does not change much; when the C content exceeds 0.3% the effect becomes important for steel U8 especially. Between 0 and 200 C the values of the temperature conductivity of tempered steels is lower, but beyond 200 C it is higher than that of annealed steels. (*In Russian.*) Vliianie zakalki na temperaturoprovodnost' uglerodistykh staleĭ. ***B. E. Neimark and V. E. Liusternik.*** *Teploenergetika,* v. 7, no. 5, May 1960, p. 16-18.

10644 On Stress Interaction in Fatigue and a Cumulative Damage Rule. II. 7075 Aluminum Alloy. The object of this investigation was the determination of the effects of stress interaction, under randomized stress distributions representing gust and maneuver loads on aircraft wings, on the fatigue life of 7075 aluminum alloy specimens. ***Alfred M. Freudenthal and Robert A. Heller.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-69, pt. 2, Jan. 1960, 17 pp. (TL507 Un3.18w Vis.)

10645 Properties of Titanium-Vanadium-Zirconium Alloys. Arc-melted Ti-V-Zr alloys ranging in composition from 5 to 20 at.% V and 5 to 30 at.% Zr were investigated to evaluate hardness, hot workability, and room-temperature tensile prop-

erties. Metallographic examination coupled with hardness measurements were used to follow structural changes and aging response. Room-temperature tensile properties are used for evaluating mechanical and engineering properties of the alloys. ***Jack D. Ramsdell and Ernest D. Hull.*** *U. S. Bureau of Mines Report of Investigations* 5604, 1960, 12 pp. (TN21 Un3r Vis.)

10646* Investigating the Strength of Seamless and Welded Tubes Under Alternating Applied Torsional Stress. Comparative tests indicated the welded tubes were stronger than the seamless ones. This is attributable to the greater notch influence of the surfaces and greater variations in wall thickness. No cracks occurred in the welded seam. (*In German.*) Untersuchung der Festigkeit von nahtlosen und längsgeschweissten Rohren bei wechselnder Drehbeanspruchung. ***Ernst August Cornelius.*** *VDI Zeitschrift*, v. 102, no. 16, June 1, 1960, p. 645-650.

10647 Effect of Elevated-Temperature Exposure on Heavy-Section Pressure-Vessel Steels. Describes the effect of aging at room temperature, 500 and 700 F on the embrittlement of C and alloy pressure-vessel steels. ***A. W. Pense, J. H. Gross, and R. D. Stout.*** *Welding Journal*, v. 39, June 1960, p. 231s-235s.

10648* Anomalies in the Elasticity Modulus and Internal Friction of the Fe_3Pt Alloy. A very large anomaly in Young's modulus and a sharp internal friction maximum are observed in the vicinity of the ferromagnetic Curie point (71 C). Superposition of a magnetic field leads to the appearance of two types of ΔE effects (of different sign) due to the domain structure and also to a decrease of the dynamic Young's modulus near the Curie point as a result of interdomain spin ordering. (*In Russian.*) Anomalii modulia uprugosti i vnutrennego treniia v splave Fe_3Pt. ***G. I. Kataev and Z. D. Sirota.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 4, Apr. 1960, p. 1037-1041.

10649* Isoentropic Compressibility of Aluminium, Copper, Lead and Iron at High Pressures. Two sound velocities corresponding to elastic and plastic states of matter were detected. The velocity of sound and the isoentropic compression moduli were determined in the pressure range $0.4–3.5 \times 10^6$ atm. The values of the thermal energies, temperature of shock compression and Gruneisen coefficients are estimated on basis of the experimental results thus obtained. (*In Russian.*) Izentropicheskaia szhimaemost' aliuminiia, medi, svintsa i zheleza pri vysokikh davleniiakh. ***L. V. Al'tshuler, et al.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 4, Apr. 1960, p. 1061-1073.

See also: **10480** (fatigue of bearing steel); **10487** (properties of bearing steel); **10523** (mechanical properties of cast austenitic Mn steels); **10555** (embrittlement of steel during pickling).

METALS—MECHANICAL WORKING

10650 Friction Characteristics of Sliding Surfaces Undergoing Subsurface Plastic Flow. It is well known that the load of an ordinary friction slider is supported by a large number of surface asperities having a collective area that is small compared with the apparent area of contact. In many metalworking operations, such as wire drawing, extruding, rolling, and metal cutting, the bulk metal undergoes plastic deformations as sliding occurs. The influence of this subsurface flow upon the coefficient of sliding friction is discussed. ***Milton C. Shaw, Abraham Ber, and Pierre A. Mamin.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 342-346.

10651 Machining Characteristics of Leaded Steel. The effects of lead on the cutting mechanism were revealed only below a critical speed, which was found to decrease for increased workpiece hardness. The effects of lead include decreased machining coefficient of friction, increased shear angle, decreased shear energy, and lower cutting forces below the critical speed. An increase in cutting speed tended to decrease tool life more when machining leaded than when machining plain steel. ***Fenton L. Bagley, Jr. and Roy Mennell.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 2, June 1960, p. 347-359.

10652* The Distribution of Stresses in Rolled Steel Sheets Caused by Inequality of Deformation Along the Thickness. The formation of Chernov-Luder lines in mild steel is connected with the presence of yield points on the stress-strain curve. In temper-rolling a reduction of 0.5-2.0% is sufficient to remove the yield point 5-7%. The inequality of deformation is studied during temper-rolling, and an attempt is made to determine the magnitude of residual stresses caused by it. (*In Russian.*) Raspredelenie napriazhenīĭ v prokatannykh listakh, vyzyvaemykh neravnomernost'iu deformatsii po tolshchine. ***V. P. Severdenko and S. A. Pasechnyi.*** *Inzhenerno-Fizicheskīĭ Zhurnal*, v. 3, no. 5, May 1960, p. 67-73.

10653* Investigation of the Influence of Different Factors on Roll Pressure, Energy Consumption, Spread and Forward Slip in Hot-Rolling. II. The study has made it possible to calculate, with greater assurance than hitherto, the total roll pressure, rolling power and energy consumption required for diamonds, squares, and ovals. This can be done either from direct readings from diagrams or by taking a flat rolling operation for purposes of comparison and calculating the required data by means of the formulae and diagrams set out in the author's earlier paper. ***G. Wallquist.*** *Jernkontorets Annaler*, v. 144, no. 3, 1960, p. 193-257.

10654* Accurate Measurements on Machine Tools by Using Optical Reading Instruments and Precision Scales. The reading device and the scale determine the correctness and the reproducibility of an optical measurement. Different reading instruments and screen reading micrometers are described. ***Walter Moser.*** *Microtecnic* (English Edition), v. 14, no. 2, Apr. 1960, p. 39-44.

10655* A Yield Criterion Applied to the Shear-Angle Relationship. A shear-angle relationship is proposed which takes into account the anisotropic properties of the work material and, indirectly, the influence of the machining feed. ***Bertil N. Colding.*** *Microtecnic* (English Edition), v. 14, no. 2, Apr. 1960, p. 47-60.

10656* Finish Turning. A description is given of a field of research newly adopted by the Technological University, Delft (Netherlands). Some progress is reported on the different types of wear, the minimum surface roughness obtainable with new tools, and on the possibility of a fine-machinability index for materials. ***A. J. Pekelharing.*** *Microtecnic* (English Edition), v. 14, no. 2, Apr. 1960, p. 61-69.

10657 Forming Beryllium Sheet. ***Herbert A. Jahnle.*** *Product Engineering*, v. 31, no. 25, June 20, 1960, p. 72-75.

10658* The New Pechiney Processes for the Continuous Fabrication of Thin Aluminum Strips. The "Four Wheels" Casting Process. After having developed and used commercially the Properzi process for the direct production of wire rod from molten metal fed by the reduction pots, the author has performed under fairly similar conditions the continuous fabrication of endless strips 11.8 in. wide and 0.11 in. thick in commercial Al and in alloys of the A-M or A-G5 series. The equipment used includes a set of furnaces, the casting machine proper, a hot rolling mill, a cold rolling mill and a double coiling-machine, all operating simultaneously. (*In French.*) Les nouveaux procédés Pechiney pour la fabrication continue de bandes minces d'aluminium. La coulée 4R. ***André Crevot.*** *Revue de l'Aluminium*, v. 37, no. 274, Mar. 1960, p. 326-331.

10659* New Methods for the Determination of Roller Wear. A study of coefficients of wear for different types of rolling mills and the dependence of wear on the type and hardness of the roller drum, the surface size of the section profile, the shape of the roller profile, and on the calibrating method. (*In Polish.*) Nowe sposoby okréslania zuzycia walców. ***Inz. J. Spyra.*** *Wiadomosci Hutnicze*, v. 16, Apr. 1960, p. 110-116.

10660* The Manufacture of Copper Wire for Enamelling. The primary technical requirements in copper wire for enamelling are low annealing temperature and high surface quality. The reasons for these requirements are explained, and details are given of manufacturing procedures adopted to meet them. ***R. D. Carter.*** *Wire Industry*, v. 27, May 1960, p. 475 + 6 pages.

See also: **10585** (vacuum annealing in steel drawing and cold rolling plants).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

10661* On the Stressed-Strained State Near a Linear Dislocation. The stressed-strained state in a body with linear dislocation is defined and the upper estimate of the linear dislocation width is given. The application of the laws of the theory of elasticity to the determination of the width of linear dislocation yields a more correct result for the value of this magnitude than that obtained by another method in paper (7). (*In Ukrainian.*) Pro napruzheno-deformovanyĭ stan bilya liniĭnoyĭ dislokatsiyĭ. ***V. V. Panasyuk and L. V. Onyshko.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi,* 1960, no. 3, p. 318-321.

10662* A Contribution to the Study of Oxide Inclusions in Iron-Chromium-Oxygen Melts. The structure of the Cr-containing oxide inclusions existing in Fe-Cr alloys with >3% Cr depends on the cooling conditions and Cr content of the melts and on the heat treatment of the alloys. Inclusions were electrolytically isolated, subjected to Cl vacuum treatment and radiographic analysis. Relations between composition and structure of the oxides and conditions of formation were discussed. (*In German.*) Zur Kenntnis der Oxydeinschlüsse in Eisen-Chrom-Sauerstoff-Schmelzen. ***Walter Koch, Joachim Bruch, and Helga Rohde.*** *Archiv für das Eisenhüttenwesen,* v. 31, no. 5, May 1960, p. 279-286.

10663* The Ternary Iron-Silicon-Beryllium System. A study covering the development of a diagram of the system by thermal analysis, structural and microscopic investigations, the discussion of phase conditions, equilibrium relationships and ternary compounds FeSiBe and $FeSiBe_2$. The solubility of Fe for Be is increased by Si from 2 to 7 wt. % Fe, that of Si by Be from 15 to 18% Si. (*In German.*) Das Dreistoffsystem Eisen–Silizium–Beryllium. ***Rudolf Vogel and Hans-Joachim Geske.*** *Archiv für des Eisenhüttenwesen,* v. 31, no. 5, May 1960, p. 319-330.

10664* The Solidification of Cast Iron and the Interpretation of Results Obtained From Chilled Test Pieces. The properties, structure, and chilling characteristics of grey cast iron are largely determined by the way in which the eutectic solidifies. Solidification of the eutectic involves nucleation and growth. The number of nuclei growing and their growth rate from a given melt increase with the amount of undercooling, which in turn increases with increase in cooling rate. Increasing S content increases nucleation of the melt and reduces the growth rate of the eutectic cells. Phosphorus increases the number of eutectic cells growing. ***H. Morrogh.*** *British Foundryman,* v. 53, May 1960, p. 221-242.

10665* Diffusion of Some Metals in Diluted Uranium Solution. The diffusion of Fe, Ni, Cr, and Si in U was studied by means of tests conducted in a heterogeneous system. A comparison of the constants of diffusion obtained with those of previous studies reveals that the coefficient of diffusion decreases when the atomic ray of the solute increases. (*In French.*) Diffusion de quelques métaux en solution diluée dans l'uranium. ***Michel Mossé, Viviane Lévy, and Yves Adda.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 250, no. 19, May 9, 1960, p. 3171-3173.

10666* A Survey of Techniques for the Preparation of Metal Single Crystals. II. Experimental Techniques. Reviews of various techniques for growth from the melt; Czochralski and Gomperz technique. ***Richard E. Holt and Douglas H. Polonis.*** *Current Engineering Practice,* v. 2, no. 9, Mar. 1960, p. 35-43.

10667* A Contribution to the Constitution Diagram of a Nickel-Chromium System. In alloy specimens of variable concentration presenting a zone of diffusion obtained by annealing a bimetallic plate (Ni covered with Cr) a eutectic transformation is shown to occur at 1200 C with decomposition of the high temperature β-phase. The reasons for this are given. (*In Russian.*) K voprosu o diagramme sostoianiia sistemy nikel'-khrom. ***B. M. Vasiutinskiĭ, V. S. Kogan, and G. N. Kartmazov.*** *Fizika Metallov i Metallovedenie,* v. 9, no. 4, Apr. 1960, p. 558-563.

10668* Investigation of the Effects of a Low Admixture of Silver on the Parameters of Volume and Boundary Diffusion in Silver and Copper. The relationship between the energy of activation of boundary and of volumetric diffusion in the case of Ag diffused in pure Cu and in Cu with 0.1 at.% Ag were respectively 0.45 and 0.51, which is close to the relationship for the self diffusion of pure Ag, that is 0.44. The width of the boundary between the energies for pure Cu and Cu with Ag admixture was of the order of 3000 - 4000 Å. (*In Russian.*) Issledovanie vliianiia maloi primesi serebra na parametry ob"emnoĭ i granichnoĭ diffuzii serebra v med'. ***S. D. Gertsriken and A. L. Revo.*** *Fizika Metallov i Metallovedenie,* v. 9, no. 4, Apr. 1960, p. 578-583.

10669* Method of Growing of Uniform Single Crystals of Doped Semiconducting Solutions and Intermetal Compounds of Definite Composition, Determined by Melt Composition. Describes the proposed method and its advantages compared with other methods. (*In Russian.*) Metod vyrashchivaniia odnorodnykh monokristallov legirovannykh poluprovodnikovykh materialov, tverdykh rastvorov i intermetallicheskikh soedineniĭ opredelennogo sostava, zadavaemogo sostavom rasplava. ***S. V. Airapetiants and G. I. Shmelev.*** *Fizika Tverdogo Tela,* v. 2, no. 4, Apr. 1960, p. 747-755.

10670 Study of Transformations by Annealing of the Body-Centered Cubic γ Phase of Uranium-Molybdenum Alloys. Study of the body centred cubic γ phase for two alloys containing six and ten per cent Mo by weight, respectively. There is a return to the equilibrium state by formation of the stable α orthorhombic and ϵ ordered tetragonal phases. Special attention has been paid to the study of intragranular reactions after low-temperature annealing, the reactions involved in this case not having been explained up to the present. (*In French.*) Étude des transformations par revenu de la phase γ cubique centreé des alliages uranium-molybdène. ***Hubert Mikaïloff.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1270, 1960, 65 pp. (QC770 F84.2r Contin.)

10671 The Structural Ageing Characteristics of Aluminium-Copper-Lithium Alloys. An X-ray study was made of Al-Cu-Li alloys aged at 165 C. The main precipitates at 165 C are θ'', θ', T_1, and δ'. Two other intermetallic compounds that occur in the ternary diagram (T_B and T_2) were not observed on aging at 165 C. Cold work nucleates Θ', and in low Cu alloys cold work nucleates T_1. ***J. M. Silcock.*** *Institute of Metals, Journal,* v. 88, pt. 8, Apr. 1960, p. 357-364.

10672 The Recrystallization Characteristics of Dilute Aluminium Solid Solutions Prepared From Zone-Refined Aluminium by Levitation Melting. The various solute elements can be divided into two groups: the first, comprising of Si, Cu, and Mg, increased the recrystallization temperature by 50-100 C. The second group, consisting of Fe, Cr, and Mn, increased the recrystallization temperature by ~200 C. Since Fe, Si, and Cu are the major impurities in super-purity Al, it is concluded from these results that the Fe content is the major factor controlling its recrystallization. ***J. C. Blade, J. W. H. Clare, and H. J. Lamb.*** *Institute of Metals, Journal,* v. 88, pt. 8, Apr. 1960, p. 365-368.

10673 Constitution of Nickel-Base Ternary Alloys. III. Nickel-Aluminium-Silicon System. IV. Nickel-Molybdenum-Titanium System. V. Nickel-Chromium-Silicon System. The phase relationships and terminal solid solubility in Ni at 1100 C were determined for the Ni-rich portion of the ternary system nickel-aluminium-silicon. Two ternary compounds were found in this region. It was observed also that although Ni_3Al and Ni_3Si are isostructural, they do not form a continuous series of solid solutions. The crystal structures of the compounds were not determined. The terminal solid solubility in Ni and the phase relationships that exist in the Ni-rich section of the Ni-Mo-Ti system were determined at 900 and 1175 C. Two ternary forms of [Ni_6(Mo, Ti)] were found, both of which undergo some kind of transformation on cooling to room temperature. The structures are complex and have not been established. The phase relationships and terminal solid solubility in Ni at 900 and 1100 C were examined for the Ni-rich alloys in

the system Ni-Cr-Si. One ternary compound (Ni_2Cr_2Si) was found, but its crystal structure is complex and was not determined. The effects of Si on the solubility of Cr are of minor importance. ***R. W. Guard and E. A. Smith.*** *Institute of Metals, Journal,* v. 88, pt. 8, Apr. 1960, p. 369-374.

10674 A Transition Phase in the Ageing of Aluminium-Zinc Alloys. A face-centered cubic transition phase was detected in the Debye-Scherrer X-ray diffraction photographs of an aluminum-25% zinc alloy during isothermal transformation at 200 C. The intermediate precipitate was granular in form and contained approximately 80% zinc. A plate-like precipitate with the hexagonal structure of Zn appeared after longer aging. ***R. D. Garwood, A. L. Davies, and G. L. Richards.*** *Institute of Metals, Journal,* v. 88, pt. 8, Apr. 1960, p. 375-378.

10675 Formation and Dissolution of Widmanstätten Structures in a Hypereutectoid Copper-Indium Alloy. The Widmanstätten structures formed during the ($\beta \rightarrow$ proeutectoid δ) reaction in a copper-32.3 wt. % indium alloy consist of needle- and plate-shaped aggregates of many smaller crystals whose morphology often bears little resemblance to that of the aggregate structures built up from them. These aggregates appear to be formed by the "sympathetic nucleation" of δ crystals at β/δ boundaries at rates which are markedly dependent upon the orientation of these boundaries. Widmanstätten δ structures dissolve almost as rapidly as they form. ***J. A. Street, H. I. Aaronson, and C. W. Spencer.*** *Institute of Metals, Journal,* v. 88, pt. 8, Apr. 1960, p. 381-384.

10676 Kinetics of First-Stage Graphitization in Commercial White Irons. The time exponent in the rate equation for isothermal, first-stage graphitization in commercial white cast irons was determined from published and new experimental data and found to be in the range 1.2-2.9. ***J. Burke.*** *Iron and Steel Institute, Journal,* v. 194, pt. 4, Apr. 1960, p. 443-445.

10677 Dislocation Multiplication in Lithium Fluoride Crystals. Experimental observations are presented of dislocation multiplication, of the defect structure left behind by a moving dislocation, and of cross-glide of individual dislocations in LiF crystals. New dislocation loops form at many different sites in the wake of a moving dislocation. These loops have the same Burgers vector as the parent dislocation. ***W. G. Johnston and J. J. Gilman.*** *Journal of Applied Physics,* v. 31, Apr. 1960, p. 632-643.

10678 Behavior of Individual Dislocations in Strain-Hardened LiF Crystals. The velocities of dislocations have been measured as a function of stress for both undeformed and deformed crystals. The motion is slower at a given stress in a strained crystal, and extra stress is needed to give the same velocity in a strained crystal as in one that is unstrained. The extra stress is just equal to the difference in macroscopic flow stresses for the two states of a crystal. ***J. J. Gilman and W. G. Johnston.*** *Journal of Applied Physics,* v. 31, Apr. 1960, p. 687-692.

10679 Precipitation in Silicon Crystals Containing Aluminum. Silicon crystals containing Al have been annealed at various temperatures within the range 700 to 1350 C, particular emphasis being given to the range 1200 to 1300 C. Precipitation, which occurs during the heat treatment in the bulk crystal and on various structural defects, has been detected by transmission optical microscopy. The precipitation of Al is interpreted in terms of a chemical reaction involving the coprecipitation of O and possibly C. ***R. Bullough, R. C. Newman, J. Wakefield, and J. B. Willis.*** *Journal of Applied Physics,* v. 31, Apr. 1960, p. 707-714.

10680* Dimensional Changes in Crystals Caused by Dislocations. Nonlinear elasticity theory is used to show how changes in the average dimensions of elastic bodies, either isotropic or anisotropic, resulting from the introduction of dislocations, can be calculated. ***R. A. Toupin and R. S. Rivlin.*** *Journal of Mathematical Physics,* v. 1, no. 1, Jan.-Feb. 1960, p. 8-15.

10681* The Effects of the Sulfur-Manganese Ratio on the Shape of Graphitic Carbon in Malleable Cast Iron. A study covering the principle of malleable cast iron production, the heat treatment methods involving the plotting of a curve of annealing temperature for black heart malleable cast iron, the effects of the chemical composition on graphitization, the temperature necessary to complete initial graphitization as a function of the Mn content in a 5 hours tempering process, the effect of the S content, of Mn excess at a temperature of 1050 C. (*In Hungarian.*) A kén-mangán-viszony hatása a temperszén képződési alakjára. ***Elemér Fülöp.*** *Kohászati Lapok,* v. 93, no. 5, May 1960, p. 112-118.

10682* Factors Influencing Diffusion and Their Role in Metallurgical Processes. A study covering the concept and laws of diffusion, its change due to temperature, pressure or concentration, its dependence on the internal structure of the material, the mechanism of atom migration in pure metals and metal alloys, the relationship between diffusion and wall thickness, some diffusion-based metallurgical processes such as metal scaling and metallic oxide reduction by solid carbon. (*In Hungarian.*) A diffúziót befolyásoló tényezők és szerepük a kohászati folyamatokban. ***Aurél-Balláné Horváth and Márta Achs.*** *Kohászati Lapok,* v. 93, no. 5, May 1960, p. 217-221.

10683* Nonmetallic Inclusions in Magnesium Cast Iron. Magnesium sulfides can be removed by flux treatment. The removal of an excess of graphite can be carried out by use of a stopper or siphon ladle and discharge of a part of the last metal. (*In Russian.*) Nemetallicheskie vkliucheniia v magnievom chugune. ***I. A. Shapranov and E. V. Petrova.*** *Liteĭnoe Proizvodstvo,* 1960, no. 5, May, p. 23-25.

10684* The Effect of Arsenic on the Crystallization of Cast Iron. Preliminary experiments with annealing of arsenic containing white iron showed that arsenic highly intensifies the first stage of graphitization, but holds back the formation of ferrite. At an increased content of arsenic the obtained die will be of perlite character, even in slow cooling castings. (*In Russian.*) Vliianie mysh'iaka na kristallizatsiiu chuguna. ***Ia. N. Malinochka and A. I. Iatsenko.*** *Liteĭnoe Proizvodstvo,* 1960, no. 5, May, p. 29-32.

10685* Investigations of Reactions Between Solid and Molten Metal Phases. Amalgamation processes were examined without any protective gas at ambient temperature. After amalgamation of Au, Sn, and Ag, phases are formed which, in the binary system, are in equilibrium with the melt at room temperature. During the reaction of Hg with Au-Sn- and Cu-Sn alloys, binary and ternary amalgams are produced. The diffusion of Hg over a Au surface follows a parabolic time-law. (*In German.*) Untersuchungen über die Reaktionen zwischen festen und flüssigen Metallphasen. ***H. Winterhager and W. Schlösser.*** *Metall,* v. 14, May 1960, p. 396-400.

10686* Effects of the Degree of Purity and of the Thermal Treatment on the Recrystallization Texture of Pure Aluminum. Investigations of single crystals of 99.8% Al revealed that in the case of the recrystallization of the crystals previously reduced by 20% there is a preferred orientation due to the increased speed of growth of the nuclei having a 111 axis at 40° to the matrix deformation. (*In German.*) Einfluss des Reinheitsgrades und der Wärmehandlung von Reinaluminium auf die Rekristallisations-Textur. ***D. Altenphol and B. Liebmann.*** *Metall,* v. 14, May 1960, p. 406-413.

10687 The Application of X-Ray Scanning Microanalysis to Some Metallurgical Problems. The value of the scanning technique in the study by X-ray microanalysis of the distribution within a metal of a particular constituent or impurity is illustrated by reference to applications concerned with inclusion analysis; the effect on hot-shortness of surface segregation in mild steel; the segregation of lead in free-cutting steels; the analysis of individual phases in a three-phase alloy. ***D. A. Melford and P. Duncumb.*** *Metallurgia,* v. 61, May 1960, p. 205-212.

10688* Influence of Nickel up to 37 Per Cent and Silicon up to 3 Per Cent on the Eutectic Carbon Content of Cast Iron. Nickel and Si additions decrease the solubility of C in liquid Fe. This report describes experiments which were carried out to evaluate the joint effects of Ni and Si on the eutectic C content of Fe over the ranges usually employed in cast iron. ***R. D. Schelleng.*** *Modern Castings,* v. 37, June 1960, p. 87-89.

10689 The Angular Dislocation. The stress field of a sharply angular dislocation is calculated by Burgers' method. It is shown that more complicated configurations may be composed

of angular dislocations, and the corresponding stress fields deduced by adding the fields of the components. ***Elizabeth H. Yoffe.*** *Philosophical Magazine,* v. 5, ser. 8, Feb. 1960, p. 161-175.

10690 The Kinetics of the Growth of Precipitates From Solid Solutions. Equations are derived for the rate of precipitation from an initially homogeneous solid solution on the assumptions that the process involves growth of existing nuclei and that the rate of growth is controlled by diffusion. Various forms of precipitate are considered. ***J. Burke.*** *Philosophical Magazine,* v. 5, ser. 8, Feb. 1960, p. 176-185.

10691* Relationships Between Steel Composition and Non-Metallic Inclusions in Aluminum Killed Steels. The Al strongly reduces silica. After this reaction has been finished, the Al begins to reduce the oxides of Mn and Fe. At the same time the Al starts to combine with N. Here the O content of the steel exerts a very important influence. (*In German.*) Zusammenhänge zwischen Stahlzusammensetzung und nichtmetallischen Einschlüssen in mit Aluminium beruhigten Stählen. ***F. Kubik.*** *Radex Rundschau,* 1960, no. 2, Apr., p. 86-99.

10692 The Electron Theory of Metals. The development of the electron theory of metals is qualitatively described. It is shown how the failures of early theories, e.g., Drude-Lorentz and Sommerfield, led naturally to the application of wave mechanical principles. The modern theory is used to explain simple properties—conductance, semiconductors and theory of alloys. ***B. L. Mordike.*** *Research Applied in Industry,* v. 13, May 1960, p. 179-186.

10693 Symposium on Electron Metallography. Presented at the Sixty-Second Annual Meeting, American Society for Testing Materials, Atlantic City, N. J., June 23, 1959. Electron microstructure of austenitic and nickel-base alloys, morphology of phases in high-temperature alloys, simplified electron metallography of steels, techniques for studying structure and growth of tin oxide, electron metallography of neutron-irradiated steels, and other problems are discussed. American Society for Testing Materials, Transactions (Annual Volume), v. 62, 128 pp. 1960. American Society for Testing Materials, Philadelphia. (TN690 Am36e)

10694 Quantitative Correlation of Irradiation Growth With Preferred Orientation in Uranium. A review is presented of the methods developed at the Savannah River Laboratory and elsewhere for quantitative correlaton of irradiation growth with preferred orientation in U and with preferred orientation characterized by X-ray and dilatometric techniques. In an application of the methods, it is shown that a strongly oriented U plate, clad in Al, was much more stable in dimensions than would be expected from the observed dimensional behavior of either unrestrained single crystals of U or Al-clad polycrystalline rod. The greater stability of the plate is attributed to a relatively strong cladding and other restraining effects. ***William R. McDonell.*** *U. S. Atomic Energy Commission, DP-*420, May 1960, 27 pp. (UF767 Un3.1dp Contin.)

10695 Proceedings of the "Lattice Defects in Noble Metals" Conference Held at Canoga Park, California, October 16 and 17, 1958. *J. A. Brinkman, C. J. Meechan, and A. Sosin, editors.* *U. S. Atomic Energy Commission, NAA-SR-*3250, 127 pp. (UF767 Un3.1na Contin.)

10696* Interpretation of Electronmicroscopic Contrasts on X-Raying of Thin Crystals. The possibility of observing lattice defects in thin metal films is discussed. After a comparison of the kinematical and dynamical theory, the light-dark contrast on the photographs is explained in terms of the former. (*In German.*) Zur Interpretation elektronenmikroskopischer Kontraste bei der Durchstrahlung dünner Kristalle. ***Helmut Alexander.*** *Zeitschrift für Metallkunde,* v. 51, Apr. 1960, p. 202-209.

10697* Investigation of Alloys in the Palladium-Copper-Chromium System. Thermal analysis and study of the microstructure after annealing and hardening between 800 and 1000 C, of the hardness, electrical resistance and its temperature coefficient were applied to this system. Constitution diagrams of binary systems and distribution of the phase regions at different temperatures in the ternary system were studied. (*In Russian.*) Issledovanie splavov v sisteme palladiĭ - med' -khrom. ***A. T. Grigor'ev, E. M. Sokolovskaia, L. N. Altunina, and M. V. Maksimova.*** *Zhurnal Neorganicheskoi Khimiĭ,* v. 5, no. 5, May 1960, p. 1112-1118.

See also: **10587** (effects of inclusions on strength of alloy steel).

METALS—POWDER

10698 Structure and Properties of Rare-Earth and Yttrium Hard Metals. Reviews preparation, structures, and properties, with emphasis on borides and silicides. ***Ira Binder.*** *American Ceramic Society, Journal,* v. 42, June 1960, p. 287-292.

10699 A Study of Grain Shape in Cemented Titanium Carbides. Presents experimental evidence which points out some conditions for the production of either round or angular carbide grains in cemented titanium carbide and gives a possible explanation for the results obtained. Nickel-titanium carbide cermets sintered on aluminum oxide exhibit rounded and hexagonal cross sections of carbide grain shapes, which results from an interaction of the compact with the substrate, increasing the O content in the compact. The addition of O to the cermet does change the cross section of the grain shape from rectangular with angular edges to hexagons with round and angular edges. The nickel cermets sintered on graphite or titanium carbide contain angular grain shapes. Cobalt-titanium carbide cermets sintered in a H atmosphere have carbide grain shapes which are angular with sharp corners, whereas the grain shapes of the compacts sintered in vacuum or He are rounded. Sintering on aluminum oxide in H produced both rounded and angular grain shapes, depending on the distance from the carbide-oxide interface. The influence of H is believed to be related with the removal of O from the compact or from the metal powders before sintering begins. The spheroidization of carbide grains in both nickel-bonded and cobalt-bonded titanium carbide can be brought about with the addition of O to the cermet. ***Thomas J. Whalen and Michael Humenik, Jr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 3, June 1960, p. 401-404.

10700 An Extruded Chromium-Alumina Alloy. A dispersion of Al_2O_3 was produced within Cr by the H reduction of a solid solution of Cr_2O_3-Al_2O_3. The resulting powder was compacted, extruded, and the material tested in tension at various temperatures and in creep at 1800 F. The material is ductile above 1200 F and is at least twice as strong as electrolytic chromium at all temperatures. Its creep resistance, rupture strength, and ductility at 1800 F warrant further work to improve its low-temperature properties. ***A. Gatti.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 3, June 1960, p. 437-439.

10701 A Cooperative Study of the Hardness Testing of Cemented Carbides. In an effort to obtain a standard testing procedure for determining the Rockwell hardness of cemented carbides, a cooperative test program has been conducted by the Cemented Carbide Producers Assn. The data obtained from test blocks have been analyzed statistically and the range of variability reported. ***Betty M. Caugherty, H. T. Oatman, and O. W. Reen.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 1261-1279, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10702* Non-Metallic Dispersions in Cobalt and Its Alloys. II. Sintered High-Temperature Chromium-Cobalt Alloys. The high room-temperature tensile strength of the sintered specimens is presumably due both to finely dispersed oxides and to non-equilibrium structures. A small increase in the sintering temperature and time from the level where highest room-temperature strength was achieved resulted in an improved creep resistance. ***Rudolph Palme.*** *Cobalt,* no. 7, June 1960, p. 13-25.

10703 An Investigation of Intermetallic Compounds for Very High Temperature Applications. Intermetallic compounds from 35 binary metallic systems were prepared, fabricated into oxidation-test specimens, and tested for oxidation resistance in dry air at 2300 F. Only high-melting (above 2550 F) compounds were studied. These included aluminides, beryllides, silicides, germanides, and zirconides, as well as numerous miscellaneous compounds. ***Robert M. Paine, A. James Stonehouse, and Wallace W. Beaver.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 59-29, pt. 1, Jan. 1960, 236 pp. (TL507 Un3.18w Vis.)

10704 Mechanical Properties of Stainless Steel-UO_2 Dispersion Fuel Elements. Tensile test results show that cold-binder material has very good tensile properties with the exception of ductility. Bend tests show that coarse oxide material has better ductility than fine oxide both before and after irradiation. ***W. D. Valorage and R. A. Siergiej.*** *U. S. Atomic Energy Commission, KAPL*-1590, July 7, 1959, 12 pp. (UF767 Un3.1ka Contin.)

10705 Stress-Rupture Properties of Beryllium Containing Carbide and Oxide Dispersions. Some dispersion-strengthened systems of Be-BeO and Be-Be_2C were formed and tested in stress-rupture at temperatures of 1200 F (648 C), 1350 F (732 C) and 1500 F (816 C). The results, presented in a way to permit convenient comparison of the various systems, are associated with certain characteristics of the dispersion. ***J. Greenspan.*** *U. S. Atomic Energy Commission, NMI*-1227, Mar. 23, 1960, 23 pp. (UF767 Un3.1nm Contin.)

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

10706 Development of ASTM Standard Reference Blocks for Ultrasonic Inspection. A review is given of the investigation which led to the development of the ASTM aluminum alloy ultrasonic standard reference blocks described in the Recommended Practice for Fabricating and Checking Aluminum Alloy Ultrasonic Standard Reference Blocks (E 127-58 T). ***F. C. Panian and H. E. VanValkenburg.*** Paper from "American Society for Testing Materials, Proceedings, 1959", v. LIX, p. 1237-1260, 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)

10707 Recommended Practice for Radiographic Inspection of Fusion-Welded Joints. To increase the contrast, the tube voltage must be as low as practicable. Films should be processed in accordance with the recommendations. The brightness of the screen for viewing should preferably be adjustable. *British Welding Journal*, v. 7, June 1960, p. 410-414.

10708 Improved Weld Inspection Methods: Magnetographic Method. Improvements made in recent months to apparatus for the magnetographic inspection of welds are reported. ***I. E. Neifel'd and A. S. Fal'kevich.*** *Henry Brutcher Translation No.* 4734, 8 pp. + 2 tables. (Partial translation from *Svarochnoe Proizvodstvo*, 1959, no. 2, Feb., p. 19-21.) Henry Brutcher, Altadena, Calif.

10709* Nondestructive Testing of Large Solid Propellant Case-Bonded Rocket Motors. Polaris motors have a star-shaped perforation. Radiographic examination is performed by simultaneously exposing film placed in the bore and at the periphery just below the tangent points. Using a General Electric 2-mev X-ray unit and production procedures developed at NAD Concord, complete radiographic examination is accomplished in 10 to 24 hours on second- and first-stage motors. An analysis of the tangential radiographic method is given and ultrasonic test methods of bond testing are discussed. ***John H. Cusick.*** *Nondestructive Testing*, v. 18, no. 3, May-June 1960, p. 195 + 5 pages.

10710* Ultrasonic Weld Inspection—A Status Report. Excellent results have been obtained utilizing straight beam techniques, rather than angle beam when the surface conditions permit, or on such special shapes as T-welds, nozzles, etc., and also transmission techniques, particularly on very thin wall seam welds. ***John E. Bobbin.*** *Nondestructive Testing*, v. 18, no. 3, May-June 1960, p. 200-202.

10711 Nondestructive Measuring Method of Polarization for the Study of Ferroelectrics. The piezoelectric output voltage of a ferroelectric crystal in an ultrasonic field is determined by its state of polarization. By using this property, a technique has been developed for the measurement of polarization without disturbing the domain configuration. This ultrasonic method has several advantages over the Sawyer-Tower method and Chynoweth's pyroelectric method. Quasi-static hysteresis measurements of a barium titanate single crystal have been carried out to illustrate the method. ***K. Husimi and K. Kataoka.*** *Review of Scientific Instruments*, v. 31, Apr. 1960, p. 418-421.

10712 The Agents Responsible for the Deterioration of Electronic Equipment. The mechanical, climatic (direct and indirect) and physicochemical agents of deterioration were subjected to suitable rapid tests to determine the resistance of the component part and of the entire equipment. Adaptation of the equipment to the right surrounding conditions at a given time was emphasized. (*In Spanish.*) Los agentes responsables de la degradación de equipos electrónicos. ***J. M. Alameda.*** *Revista de Ciencia Aplicada*, v. 14, no. 73, Mar.-Apr. 1960, p. 121-129.

10713* How to Interpret Radiographs. In non-destructive testing, the test is only as good as the explanation of the results. It is important therefore to explain the radiographs. ***Robert Chuse.*** *Welding Engineer*, v. 45, June 1960, p. 34-35.

10714* Ultrasonic Testing Is a Fast, Economical Means of Discovering Weldment Flaws. From a dog whistle to submarine detection to NDT's latest entry, ultrasonics has proved itself a worthy companion to radiography. *Welding Engineer*, v. 45, June 1960, p. 40-41.

10715* For Surface and Near-Surface Inspection, Use Penetrants and Magnetic Particles. The shape and size of the crack is outlined by Fe particles. For non-magnetic materials a fluorescent penetrant method makes use of the black (almost ultraviolet) light. *Welding Engineer*, v. 45, June 1960, p. 44 + 1 page.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

10716* Study of a Few Excited Levels of ^{11}B by the Method of the Angular Distribution and Correlations of Stripping. The distributions and correlations corresponding to the 4.46, 5.03, 6.76, (and 6.81) and 7.30 MeV levels of ^{11}B were measured. The curve of excitation of the ^{10}B (dp) reaction for the first four levels and the angular γ-γ correlations starting from 9.19 and 9.28 MeV of ^{11}B were studied. The multipole mixture of the γ-radiation of 4.46 MeV was quantitatively determined. (*In French.*) Étude de quelques niveaux excités du ^{11}B par la méthode des distributions et corrélations angulaires de stripping. ***Michel Croissiaux.*** *Annales de Physique*, v. 5, ser. 13, nos. 3-4, Mar.-Apr. 1960, p. 409-467.

10717* Characteristic Parameters of Gas-Tube Proportional Counters. I. Methane, Methane-Argon, and Ethanol-Argon Counters. The gas multiplication factor A_0 was determined in cylindrical counters at specific counter wire voltages and varied pressures, wire radii and counter shell radii for methane and various methane-argon mixtures, as used in proportional counters. It is seen that the Rose-Korff and the Curran-Craggs-modified Rose-Korff theory do not agree with the experimental results. ***Robert W. Kiser.*** *Applied Scientific Research, Sec. B. Electrophysics, Acoustics, Optics, Mathematical Methods*, v. 8, no. 3, 1960, p. 183-200.

10718 The Atomic Industry—1958. A progress report outlining the role of American industry in developing the commercial applications of atomic energy. 12 pp. 1958. Atomic Industrial Forum, New York. (TK9145 At72a Over.)

10719 Fast Neutron Physics. Pt. I. Techniques. Neutron sources, recoil detection methods, detection by neutron-induced methods, and special techniques and problems are discussed. ***J. B. Marion and J. L. Fowler, editors.*** 983 pp. 1960. Interscience Publishers, New York. (QC721 M33f)

10720 Investigation of the Separation Coefficient of Some Processes Concerning Lithium Isotopes. These few investigations permit the control or determination for a certain number of processes the order of value of separation factors. Thus on electrolysis in aqueous solution the values of α, which were measured in this study, are in agreement with those published by Holleck, Johnson and Hutchinson. (*In French.*) Étude du coefficient de separation de quelques processus concernant les isotopes du lithium. ***L. Perret, L. Rozand, and E. Saïto.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1029, 1958, 16 pp. (QC770 F84.2r Contin.)

10721 Health Physics Instrumentation. Radiation detectors, portable survey instruments, fixed monitors, neutron monitors, counting rooms and equipment, calibration techniques, miscellaneous instrumentation, and allied equipment are discussed. ***John S. Handloser.*** 182 pp. 1959. Pergamon Press, New York. (QC786 H19h)

10722 Factors Which Will Influence Early Application of Nuclear Rockets. Within the framework of the general configuration and the various missions for which these space vehicles are planned the potential performance which nuclear rockets may provide is illustrated. ***H. R. Schmidt and R. S. Decker.*** *IRE Transactions on Nuclear Science,* v. NS-7, no. 1, Mar. 1960, p. 6-12. (TK1 In6.6ns Vis.)

10723 Electronic Engineering Design Problems in Fusion Research. Particular emphasis is placed on the development of large energy storage systems, and transfer and utilization of this energy. In addition, design criteria for data reduction systems, and other problems related to our fusion research program are discussed. ***Vernon L. Smith.*** *IRE Transactions on Nuclear Science,* v. NS-7, no. 1, Mar. 1960, p. 13-23. (TK1 In6.6ns Vis.)

10724* Investigation of Heat Transfer Processes in Fuel Elements of Nuclear Reactors by the Hydraulic Analog Method. Considers the one-dimensional aspect of the temperature field with inner heat sources applicable to fuel elements of water-moderated water-cooled reactors. In the solution, boundary conditions of the fourth type are used on contact boundaries of separate layers of fuel elements, and conditions of the third type on inner surfaces. (*In Russian.*) Issledovanie protsessov perenosa tepla v teplovydeliashchikh elementakh iadernykh reaktorov metodom gidravlicheskogo modelirovaniia. ***O. I. Iaroshevich.*** *Inzhenerno-Fizicheskĭi Zhurnal,* v. 3, no. 5, May 1960, p. 81-85.

10725 Burn-up Program for a Two-Core Converter Reactor. Calculations have been performed assuming the excess reactivity of the outer core to be 0.04, the total power output to be 1200 Mw, the power density being 0.6 w/cm^3. The calculation has been carried through a 650 IBM computer, the code used being written in the Wolontis Interpretative System. The calculations have been done for a set of critical designs which are listed in Table II. ***D. Baroncini.*** *Italy, Comitato Nazionale per le Ricerche Nucleari, CNC-*27, Mar. 1960, 66 pp. (QC770 It1.2c Contin.)

10726* The Prospect for a Nuclear Powered Dry Cargo Liner With Particular Reference to the Organic Moderated Reactor. The whole problem is discussed in detail. Cross sections of a nuclear ship with general arrangement are cited. A sketch of the reactor room is given. Calculations and tables are cited. ***E. C. B. Corlett and E. P. Hawthorne.*** *Joint Nuclear Marine Propulsion Panel, Journal,* v. 4, no. 1, Apr. 1960, p. 1-35.

10727* Some Aspects of Marine Reactor Safety. Engineering aspects of shielding, containment and fuel element design are covered by analysis of the problems and suggestions for methods of calculation. Hazards peculiar to commercial marine installations are considered and safety recommendations made. Finally, a detailed survey is made of accidents to large ships over the last decade, from which are deduced guide lines on ship structure and equipment applicable to nuclear powered vessels. ***K. Maddocks.*** *Joint Nuclear Marine Propulsion Panel, Journal,* v. 4, no. 1, Apr. 1960, p. 37-66.

10728* Interpretation of Quantitative Mechanics. II. Determination of the Probability of Presence. Taking into consideration his previous work the author formulates the exact initial conditions to which is subjected the probability density of occurence of positions $w(x, y, z)$ of a microcorpuscule μ. It is shown that the function $f(x, y, z)$ in which $[f]^2 = w$ should satisfy a differential equation of the Sturm-Liouville type. The initial conditions determine its coefficients in a unique way, thus getting a probability equation for f, identical to Schrödinger's equation for this case. (*In French.*) Sur l'interprétation de la mécanique quantique. II. Détermination de la probabilité de présence. ***A. B. Datzeff.*** *Journal de Physique et le Radium,* v. 21, no. 4, Apr. 1960, p. 201-211.

10729* The Action of the Boltzmann Elastic Collision Operator on an Isotropic Function of Velocities in an Imperfect Lorentzian Gas. The elastic collision operator is explained for the isotropic part of an imperfect Lorentzian gas. The formula of Chapman and Cowling is reobtained and the fields in which it is valid are specified. (*In French.*) Action de l'opérateur de collision élastique de Boltzmann sur une fonction isotrope des vitesses, dans un gaz Lorentz imparfait. ***E. Moreau and J. Salmon.*** *Journal de Physique et le Radium,* v. 21, no. 4, Apr. 1960, p. 217-222.

10730* Investigation of the Electron Spectrum on Autoionisation by β Radioactivity. Following already published experiments on ^{32}P, ^{35}S, ^{147}Pm, results are given for ^{90}Y, ^{142}Pr and ^{22}Na. The intensities of the X, K or L lines, are in good agreement with the theory of autoionization. On the other hand the continuous spectra, between 1 and 13 kev, of autoionization electrons emitted simultaneously with β radiation disagree with theoretical predictions. (*In French.*) Étude expérimentale du spectre des électrons d'autoionisation en radioactivité β. ***F. Suzor.*** *Journal de Physique et le Radium,* v. 21, no. 4, Apr. 1960, p. 223-228.

10731 Vacuum Sublimation Apparatus for Preparation of Thin Sources of α-Active Materials. Describes a method of preparing sources for α-pulse analysis, by subliming the oxide at 2000 C from a Ta filament. Sources so prepared gave good uniform resolution with a peak width at half height of 35 keV or better. ***N. Jackson.*** *Journal of Scientific Instruments,* v. 37, May 1960, p. 169-171.

10732* On the Decay Interaction of Strange Particles. It is proposed that the strength of the coupling constants is different for the strangeness non-conserving and strangeness conserving currents in the scheme of Fermi interactions of an ordinary charged current-current type. ***B. Sakita and S. Oneda.*** *Nuclear Physics,* v. 16, no. 1, Apr. 1960, p. 72-80.

10733* Electric and Magnetic Moments of Odd-Neutron Nuclei on the Single Configuration Model. The quadrupole moments of odd-neutron nuclei may be obtained by the promotion of two protons from the zeroth order proton state of seniority zero to the states of seniority two. These mixing coefficients of the ground state are determined by fitting the wave function to the magnetic moment of the odd-neutron nucleus considered. ***Hajime Narumi and Hiroyuki Nagai.*** *Nuclear Physics,* v. 16, no. 2, May 1960, p. 193-205.

10734* Resonant Absorption of the Gamma Radiation From the $Ne^{22}(p, \gamma)Na^{23}$ Reaction. The gamma rays emitted in the reaction $Ne^{22}(p, \gamma)Na^{23}$ at $E_p = 637$ kev have been selectively absorbed in sodium fluoride, using the technique of collision produced Doppler shift. Resonant absorption of the 9.40 Mev gamma rays occurs at 74°.3 with respect to the proton beam direction. The instrumental resolution curve has been determined by observing the resonant absorption of the 12.33 Mev gamma radiation from the reaction $Al^{27}(p, \gamma)Si^{28}$ at $E_p = 771$ kev. ***W. L. Mouton and P. B. Smith.*** *Nuclear Physics,* v. 16, no. 2, May 1960, p. 206-214.

10735* Classification of Beta- and Gamma-Ray Transitions Between Intrinsic States in Deformed Even-Mass Nuclei. The experimental transition rates in even-mass nuclei to which definite configurations can be assigned are observed to fall within well-defined ranges characteristic of the degree of forbiddenness predicted by the selection rules. Furthermore, the data on log ft-values indicate that single-particle transitions occur with essentially the same speed whether the transforming particle is in an odd-mass or an even-mass nucleus. ***C. J. Gallagher.*** *Nuclear Physics,* v. 16, no. 2, May 1960, p. 215-230.

10736* Isomers in $N = 81$ Nuclei. Two new isomers, Nd^{141m} and Sm^{143m}, were found from the (γ, n) reactions on natural neodymium and samarium. Their energies and half lives as well as those of previously known Ce^{139m} and Xe^{135m} were determined very precisely by careful and repeated measurements. ***K. Kotajima and H. Morinaga.*** *Nuclear Physics*, v. 16, no. 2, May 1960, p. 231-245.

10737* Nuclear Polarization of Co^{55}. The angular distribution and linear polarization of the gamma rays emitted from 18-h Co^{55}, polarized at low temperatures in cerium-magnesium nitrate crystals, have been measured. With a spin of 7/2 for Co^{55}, we find a spin sequence of $7/2 \rightarrow 5/2 \rightarrow 3/2$ in the main decay in Fe^{55}, and for the 0.935 Mev gamma ray a σ of $+ 0.36 \pm 0.11$. ***Rudolf W. Bauer and Martin Deutsch.*** *Nucelar Physics*, v. 16, no. 2, May 1960, p. 264-277.

10738* Introduction of Many-Particle Variables for the Treatment of Special Translationally Invariant Many-Body Problems. An attempt is made to treat special translationally invariant many-body problems by coordinate transformations introducing many-particle variables. These are adapted coordinates of such kind that the condition of translational invariance and the Pauli principle can be satisfied automatically. They are homogeneous functions of the particle coordinates obeying certain differential equations. The Schrödinger equation is transformed into these variables. ***P. Möbius.*** *Nuclear Physics*, v. 16, no. 2, May 1960, p. 278-303.

10739* Regularized Vacuum Expectation Values in Quantum Field Theory. A formal method of regularizing vacuum expectation values of Heisenberg current operators is introduced by imposing certain conditions on the spectral functions. The method is applied to Källen's calculation of the vacuum-polarization in an external electromagnetic field and leads to results which are explicitly gauge-invariant. ***John W. Moffat.*** *Nuclear Physics*, v. 16, no. 2, May 1960, p. 304-312.

10740* Modification of the Form of Potential in an Excited Nucleus and Its Effect on the Barrier Transmission Coefficient. The transmission coefficient of the nuclear potential barrier is calculated by taking into account the fact that the density distribution of an excited nucleus differs from that of one in the ground state. As an example the potential barrier of an excited nucleus of mass number 40 is determined on the basis of the statistical model and it is found that for 15 MeV excitation energy the transmission coefficient for protons emitted with 2 MeV energy is twice as large as that for a nucleus in the ground state. ***J. Németh.*** *Nuclear Physics*, v. 16, no. 2, May 1960, p. 331-338.

10741 The Reactivity of Natural UO_2 Irradiated to 6 x 10^{21} n/cm². Natural uranium dioxide specimens of Shipping-port PWR-1 blanket-rod geometry are exposed in the Materials Testing Reactor and discharged periodically for measurements in the Reactivity Measurement Facility (RMF). The time-integrated thermal and epithermal fluxes are measured during each exposure cycle, and together with the MTR Daily Power Logs, give the complete exposure history. ***S. B. Gunst, E. D. McGarry, and J. J. Scoville.*** *Nuclear Science and Engineering*, v. 7, May 1960, p. 407-418.

10742 An Investigation of Effective Neutron Temperatures. Information about effective neutron temperatures has been inferred from measurements of the ratio of the thermal-fission activity of a Pu^{239} foil to that of a U^{235} foil. A discussion of the ratios obtained in various assemblies which were placed in the center of a graphite thermal column is presented. ***W. P. Stinson, L. C. Schmid, and R. E. Heineman.*** *Nuclear Science and Engineering*, v. 7, May 1960, p. 435-441.

10743 Experimental Investigations of Pressure Drop Through Interrupted-Plate-Type Fuel Elements. The joint losses between adjacent sections of a plate-type subassembly, and the entrance-plus-exit losses on entering the initial section and leaving the final section of subassembly, have been measured as a function of Reynolds Number and, in the case of the joint losses, as a function of the spacing between the sections. Experimental values of dimensionless joint loss and entrance-plus-exit loss coefficients were calculated from experimental over-all pressure drops using values for the friction factor from the literature. ***B. W. LeTourneau and R. E. Grimble.*** *Nuclear Science and Engineering*, v. 7, May 1960, p. 458-467.

10744 How Focusing Collisions Affect Radiation Damage. In general, one can visualize the recoiling atom as producing initially both damage and focused packets in widely spaced collisions. In materials where the effect appears at relatively high energies a large proportion of the recoil energy will be focused and eventually converted to lattice vibrations without producing permanent damage. ***Michael W. Thompson.*** *Nucleonics*, v. 18, June 1960, p. 133 + 5 pages.

10745* Eigenvalues of π-Electrons in a Potential Box With an Even Number of N-Barriers. A general formula was derived for computing eigenvalues for the π-electrons in a periodic field with an even number of barriers. A model of a metallic molecule in an infinitely deep well was utilized. The formula obtained was used to evaluate the electron energy levels for $C_{10}H_{12}$. ***S. M. Vazykova.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 7, no. 6, Dec. 1959, p. 433-435.

10746 A 10 in. Diameter Liquid Hydrogen Bubble Chamber. The important design features of a 10 in. hydrogen bubble chamber, its magnet and the associated control circuitry are presented. ***Margaret H. Alston, D. C. Cundy, W. H. Evans, R. W. Newport, and P. R. Williams.*** *Philosophical Magazine*, v. 5, ser. 8, Feb. 1960, p. 146-153.

10747 Energy Levels in ^{28}Si From the $^{27}Al(p,\gamma)^{28}Si$ Reaction. The γ-ray spectra from twelve $^{27}Al(p,\gamma)^{28}Si$ resonances in the $E_p = 500$ to 800 keV region were investigated with scintillation spectrometers. Both single and coincidence spectra were measured from which the branchings were obtained in the decay of the resonance levels and of lower levels at 1.783 ± 0.008 and other levels at 9.31, 9.38, and 10.71 MeV very probably have $T = 1$ character. ***P. M. Endt and A. Heyligers.*** *Physica*, v. 26, Apr. 1960, p. 230-254.

10748 On the Energy Gap of the Dilute Fermi Gas for Negative Two Body Scattering Length. Von Hove has pointed out certain difficulties in the application of perturbation theory to a dilute gas of Fermi particles with a negative two body scattering length. It is shown here that these difficulties may be circumvented if one perturbs, not from the non-interacting ground-state, but rather from some other groundstate. ***David S. Falk and Th. W. Ruijgrok.*** *Physica*, v. 26, Apr. 1960, p. 266-268.

10749 Motion of a Heavy Particle in a One Dimensional Chain. The velocity auto-correlation function of a heavy particle substituted in a one dimensional lattice of identical particles is calculated. The behavior of this function is such that the particle obeys over a restricted time range, a Langevin equation for a harmonically bound particle. ***R. E. Turner.*** *Physica*, v. 26, Apr. 1960, p. 269-273.

10750 Higher Resonances in Pion-Nucleon Interactions. The recent experiments on pion-nucleon scattering and photoproduction at energies up to about 1.2 Bev are examined from a phenomenological standpoint. The most useful information seems to come from the photoproduction angular distribution and polarization results. The data seem to imply the existence of two "resonances" in the $J = \frac{3}{2}$, odd parity and $J = \frac{5}{2}$, even parity states. ***Ronald F. Peierls.*** *Physical Review*, v. 118, 2nd ser., no. 1, Apr. 1, 1960, p. 325-335.

10751 Pulsed Nuclear Resonance Spectroscopy. A technique for the detection of weak nuclear resonance interactions in solids is carried out by a pulsed method which obtains nuclear double resonance. The resonance of the unkown species to be detected does not require a Boltzmann population difference in spin orientation, but must have a sufficient dipole-dipole interaction with a second spin species. ***M. Emshwiller, E. L. Hahn, and D. Kaplan.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 414-424.

10752 Energy Spectra of Protons From (d,p) Reactions in Heavy Elements. Survey of proton energy distributions from (d,p) reactions were made on nuclei with $Z > 30$ using resolutions of 500 and 80 kev. The gross structure shows broad peaks due to the major nuclear shells. The energies of the various peaks do not shift from element to element in the manner expected from simple theory. The results and their interpretation given here are in direct conflict with the Wilkinson theory of

γ-ray giant resonances. ***B. L. Cohen, J. B. Mead, R. E. Price, K. S. Quisenberry, and C. Martz.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 499-506.

10753 Neutron Production by Heavy-Ion Bombardments. Neutron yields from C^{12}, N^{14}, and Ne^{20} bombardments of a number of target elements have been measured by an activation method. The maximum bombarding energies were 10.4 Mev per nucleon of the incident ion. Calculated neutron yields are a factor of about two higher than experiment in the case of heavy target nuclei, with greater differences for light targets. ***Edward L. Hubbard, Robert M. Main, and Robert V. Pyle.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 507-514.

10754 Differential Cross Sections for Neutron Resonance Scattering From Na^{23}. The differential scattering cross section for neutrons on Na has been measured with an energy spread of ~ 25 kev for neutron energies between 200 kev and 800 kev. The data are presented in the form of Legendre polynomial coefficients. ***R. O. Lane and J. E. Monahan.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 533-535.

10755 Angular Distribution of Fragments From the Fission of Bismuth by 450-Mev Protons. Test experiments on the "bead-cone" method used for the measurement of the angular distribution of fission fragments from the 450-Mev proton fission of bismuth have been performed. These experiments make doubtful the conclusions of the previous measurement. ***M. V. Ramaniah and Nathan Sugarman.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 562-563.

10756 $\pi+$—p Interactions Producing $\Sigma+ - K^+$ in a Propane Bubble Chamber. Seven cases of production of $\Sigma^+ - K^+$ by 1.0-Bev $\pi^+ - p$ interactions have been identified in the Yale propane bubble chamber. In six of these cases, the Σ^+ direction was forward in the center-of-momentum system. The cross section derived from these is 0.08 mb. The decay of the Σ^+ is equally divided between the pion and proton decay modes. ***W. H. Hannum, et al.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 577-579.

10757 Positron Annihilation in Aqueous Solutions. It was confirmed that the amount of singlet positronium formed is influenced by two processes: a reduction of positronium due to electron capture by oxidizing substances and an increase of the triplet → singlet conversion due to the electron exchange with paramagnetic ions. The oxidation potential of positronium is found to be very nearly zero. ***Georg Trumpy.*** *Physical Review*, v. 118, 2nd ser., no. 3, May 1, 1960, p. 668-674.

10758 Total Neutron Cross Sections of Helium, Neon, Argon, Krypton, and Xenon. The total neutron cross sections of the noble gases He, Ne, Ar, Kr, and Xe have been measured for neutron energies from 120 kev to 6.2 Mev and from 12.1 Mev to 19.8 Mev by a transmission experiment. The neutrons were produced using the Li^7 $(p, n)Be^7$, the $T(p, n)He^3$, the $D(d, n)He^3$, and the $T(d, n)He^4$ reactions in the appropriate energy intervals. ***F. J. Vaughn, W. L. Imhof, R. G. Johnson, and M. Walt.*** *Physical Review*, v. 118, 2nd ser., no. 3, May 1, 1960, p. 683-686.

10759 Precision Measurement of the Total Neutron Cross Section of U^{233} Between 0.000818 and 0.0818 ev. The absolute value of the total neutron cross section of U^{233} was measured at neutron energies between 0.000818 ev and 0.0818 ev for two types of samples, a metallic foil and D_2O solutions of uranium nitrate. Balanced solutions of $U^{233}O_2(NO_3)_2$ and $U^{238}O_2(NO_3)_2$ were used to determine the difference between the total cross sections of U^{233} and U^{235}. ***G. J. Safford, W. W. Havens, Jr., and B. M. Rustgd.*** *Physical Review*, v. 118, 2nd ser., no. 3, May 1, 1960, p. 799-802.

10760 An Investigation of Some (^{3}He, α) Reactions on Light Nuclei at 5·2 MeV. The reactions $^{11}B(^3He, \alpha)^{10}B$, $^{10}B(^3He, \alpha)^9B$, $^{14}N(^3He, \alpha)^{13}N$, $^{16}O(^3He, \alpha)^{15}O$ and $^{27}Al(^3He, \alpha)^{26}Al$, have been investigated at an incident energy of 5·2 MeV, using a broad range magnetic spectrograph. Angular distributions and absolute cross sections for alpha particles leading to the ground states and several excited states of the final nuclei have been measured. ***I. J. Taylor, F. de S. Barros, P. D. Forsyth, A. A. Jaffe, and S. Ramavataram.*** *Physical Society, Proceedings*, v. 75, pt. 5, May 1960, p. 772-780.

10761 Pure and Applied Physics. Pt. B. Nuclear Spectroscopy. Concerned with the ways in which experimental data may be analyzed to furnish information about nuclear parameters, and with the nuclear models in terms of which the data are interpreted. Some of the techniques discussed here have not been previously presented in detail in the printed literature. ***Fay Ajzenberg-Selove, editor.*** 522 pp. 1960. Academic Press, New York. (QC784 N88)

10762* Reactor Core Materials. A review of recent developments in fuel and fertile materials, in moderator materials, in nuclear poisons, cladding and structural materials, and special fabrication techniques is given. v. 3, no. 2, May 1960, 55 pp.

10763* Reactor Fuel Processing. A review of recent developments is given. Commercial aspects of fuel processing, safety in chemical processing, preparation for fuel processing, research and development on fuel processing, waste disposal, production of U, Th, Pu, and their compounds are discuussed. *Reactor Fuel Processing*, v. 3, no. 2, Apr. 1960, 49 pp.

10764 Low Background Thin-Wall Flow Counters for Measuring Beta Activity of Solids. The construction and performance of disk-shaped thin-walled flow counters suitable for measuring very small β activities of solids is described. The circular faces, which serve as the cathode, consist of conducting films. Either a single pear-shaped loop of wire whose plane is parallel to that of the faces, or a group of straight wires stretched across the midplane serves as the anode. The counters are operated in the Geiger region. Performance data are given for counters having active volumes ranging from 0.2 to 7 cc, and having active areas from 1.6 to 23 cm^2. Counting efficiencies for natural K (mounted on Lucite) vary from 30-47% depending on the relationship of sample area to counter dimensions. Inside a 20-cm steel shield and an anticoincidence ring the background counting rates varied approximately as 1 count/hr/cm^2 of counting area. Background as low as 1 count/hr were obtained. ***Devendra Lal and David R. Schink.*** *Review of Scientific Instruments*, v. 31, Apr. 1960, p. 395-398.

10765 Rapid Cycling Bubble Chamber. The operation of a 500-cc compressed N driven propane bubble chamber at cycling rates up to 15 cps is described. A vapor pressure of 310 psi is found as optimum with a 540-psi compression pressure and a 7% volume change. The chamber was expanded into a 170-psi exhaust chamber. Excessive boiling and sensitive time are related to the cycling rate and expansion time. ***Carl Wayne Vernon.*** *Review of Scientific Instruments*, v. 31, Apr. 1960, p. 421-424.

10766 Nevis Synchrocyclotron Slow Neutron Velocity Spectrometer. A high-intensity, high-resolution neutron velocity selector system, employing the Nevis synchrocyclotron as a source of pulsed neutrons, is described. Detector counts are accumulated in a 2000-channel analyzer with 0.1-μ sec channel width. Punch card data reduction techniques are discussed. ***J. Rainwater, W. W. Havens, Jr., J. S. Desjardins, and J. L. Rosen.*** *Review of Scientific Instruments*, v. 31, May 1960, p. 481-489.

10767 Effect of Gaseous Impurities on BF_3 Proportional Counters. The effect which SiF_4, SO_2, and SF_6 have on the plateau and the pulse size distribution of a proportional counter were investigated. SiF_4 was tested at three pressures, 30, 45, and 60 cm, of BF_3 and its effect was found to be independent of the counter pressure for the range of value considered. ***J. Davila Aponte and S. A. Korff.*** *Review of Scientific Instruments*, v. 31, May 1960, p. 532-536.

10768 The Mössbauer Radiation. Low-energy gamma rays provide the most precisely defined electromagnetic frequency yet discovered. ***Winston E. Kock.*** *Science*, v. 131, May 27, 1960, p. 1588-1590.

10769 Thermal Shock Tests of a Plate-Type Nuclear Superheater Fuel Element Design. *R. J. Gariboldi.* *U. S. Atomic Energy Commission, ANL-6086*, Mar. 1960, 14 pp. (UF767 Un3.1an Contin.)

10770 An Automatic Gas Chromatograph for Monitoring of Reactor Fuel Failures. I. Design. A device was developed for detecting the failure of a fuel element in a reactor by monitoring for the presence of gaseous fission products. Small amounts of gaseous fission products were detected in the pres-

ence of radioactive Ar by separating the fission product gases from the Ar by chromatography. An automatic sequencing device was provided for taking samples at short intervals to ensure rapid detection of failures. ***William R. Kritz.*** *U. S. Atomic Energy Commission, DP-356,* Apr. 1959, 10 pp. (UF767 Un3.1dp Contin.)

10771 Plutonium Recycle Test Reactor Final Safeguards Analysis. Supplement I. Additional Studies. *U. S. Atomic Energy Commission, HW-61236,* Apr. 15, 1960, 33 pp. (UF767 Un3.1hw Contin.)

10772 Reactor Technology Report No. 12. Metallurgy. Contains the following sections: arc welding of inconel for nuclear power plants, stability of lead and bismuth tellurides on pulse heating to successively higher temperatures, creep-rupture properties of internally pressurized zircaloy-2 tubing, fatigue tests of fuel-cell tube-structure welds, cyclic strain fatigue of inconel up to 600 F, chromium electroplates for corrosion protection of stressed AISI 410 in high-temperature, high-purity waters, process description for covering metal with a laminated ceramic coating, application of inconel to components of pressurized, high-temperature-water nuclear reactor systems, effect of untempered martensite on susceptibility of AISI 410 Steel to stress-corrosion cracking, the dimensional instability of fissionable materials during reactor irradiation, and dysprosium oxide ceramics. *U. S. Atomic Energy Commission, KAPL-2000-9,* Mar. 1960, sections individually paged. (UF767 Un3.1ka Contin.)

10773 Safeguard Report on the Proposed Method of Annealing Graphite in the X-10 Reactor. The ORNL Graphite Reactor moderator has undergone approximately 16 years of almost continuous irradiation. Throughout this time stored energy has accumulated at a slow rate to the present maximum value of about 35 cal/gm releasable to 250 C. A small portion of the moderator (approximately 4%) contains stored energy which under adiabatic conditions may be released spontaneously (at approximately 165 C) to produce a maximum temperature of 270 C. Careful analysis has shown that the present condition is not hazardous; however, it appears wise at this time to initiate some corrective action (thermal annealing) to prevent the continued buildup of stored energy to a dangerously high value. The proposed procedure requires a slow heatup of the moderator under full reversed, air-flow conditions. This can be accomplished by slowly raising the reactor nuclear power level until the desired graphite temperature is attained. During the initial stages of the operation, the stored energy will be reduced to a sufficiently low value that spontaneous energy release is no longer possible. This can be accomplished at temperatures (less than 140 C) well below the minimum (165 C) required for spontaneous energy release. Subsequent higher temperature may then be employed to further reduce the stored energy. Recurrence of stored energy which may be released spontaneously can be prevented by periodic annealing at rather infrequent intervals. ***L. E. Stanford.*** *U. S. Atomic Energy Commission, ORNL-2725,* May 18, 1960, 147 pp. (UF767 U3o Contin.)

10774 Fission Product Distribution in ORR Fuel Elements. The gamma rays emitted by ORR fuel elements and by the fuel section of shim rods are measured as a function of position along the elements with a very small graphite ionization chamber. Comparison of the fuel burnup calculated from the gamma measurements and by the flux-time method shows good agreement. This means that the gamma-ray distribution measurements could be a good method of determining the U^{235} consumption in fuel elements. Distributions of the macroscopic absorption cross section and the infinite multiplication factor along fuel elements are computed from the gamma dose rate distribution. The limited usefulness of the shim rod fuel section is discussed in the last section. ***A. L. Colomb.*** *U. S. Atomic Energy Commission, ORNL-2897,* May 19, 1960, 9 pp. (UF767 U3o Contin.)

10775 Interactions of Antiprotons in Hydrogen, Beryllium, and Carbon. With the use of strong-focusing magnetic quadrupoles, a crossed electric- and magnetic-field spectrometer, and time-of-flight scintillation counters it has been possible to detect approximately 30 antiprotons per min. By means of a system of 4π solid-angle scintillation counters, it has been possible to measure these cross sections, including the angular distribution of elastic scattering. These cross sections have been meaured for antiprotons scattered from H, Be, and C in the energy range from 133 to 333 Mev. ***Bruce Cork.*** *U. S. Atomic Energy Commission, UCRL-8746,* Mar. 1960, 48 pp. (UF767 U3u Contin.)

10776 Antiproton-Proton Cross Sections at 1.0, 1.25, and 2.0 Bev. Antiprotons produced internally in the Bevatron and channeled externally by a system of bending magnets and quadrupoles were selected from background particles by using a gas Čerenkov counter and scintillation counters. At the two lower energies, an electrostatic-magnetic velocity spectrometer was used to reject background particles. A liquid-H target was completely surrounded by scintillation counters so that all charged secondaries from the antiproton-proton interactions could be detected. With the information obtained from these counters, the $\bar{P}$-P total, elastic, inelastic, and charge-exchange cross sections and the angular distribution of the elastic scatterings were obtained at each energy. The inelastic cross section was about two-thirds of the total cross section at each energy. ***Charles A. Coombes.*** *U. S. Atomic Energy Commission, UCRL-8865,* Mar. 15, 1960, 51 pp. (UF767 U3u Contin.)

10777 Charge-Exchange Scattering of Negative Pions by Hydrogen at 230, 260, 290, 317, and 371 Mev. The reaction was observed by detecting one γ-ray from the π^0 decay with a scintillation-counter telescope. The experiment was performed at Berkeley in the meson cave of the 184-in. sychro-cyclotron. The energy dependence of the γ-ray counter efficiency was measured in a separate experiment. The π^0 angular distributions were obtained from the observed γ-ray distributions by an analysis performed by using the IBM 650 computer. ***John C. Caris.*** *U. S. Atomic Energy Commission, UCRL-9048,* Mar. 18, 1960, 105 pp. (UF767 U3u Contin.)

10778 Bevatron Operation and Development. XXIII. August, September, October 1959. An external proton beam was achieved this quarter. The properties of this beam were studied and several emulsion exposures were made. A new secondary beam facility was completed at the north experimental area. This quarter the following particle physics program was carried out: Bubble chambers were used to study p-$\bar{p}$ interactions and K^+ decay modes and interactions; counter experiments were done to determine the $\pi^{\pm}$ - nucleon total cross section, the decay modes of Σ^+ and Δ^0 particles, π^+-p interactions, and Θ_1-Θ_2 mass difference. Eighteen emulsion exposures to primary and secondary beams were made for seven external groups. Fifteen target bombardments were made in the primary proton beam for the Chemistry Department. ***Walter D. Hartsough.*** *U. S. Atomic Energy Commission, UCRL-9058,* Mar. 1960, 16 pp. (UF767 U3u Contin.)

10779 Coincidence Measurements in Nuclear Decay Scheme Studies. The decay schemes of the isomers of Tc^{95} and Tc^{97} have been studied by using high-resolution conversion-electron spectrographs, γ-ray scintillation detectors, and coincidence techniques. The half-life of the 74.6-kev excited state in Np^{239} has been measured by the delayed coincidence technique as 1.2 ± 0.1 mμ sec. The directional correlations of two γ-ray cascades following the β decay of U^{237} to Np^{237} have been studied and the results are consistent with previous assignments of the total angular momenta of the excited states. An upper limit on the half-life of the 332-kev excited state in Np^{237} was determined to be 1.0 mμ sec. Electron-electron coincidence measurements have been performed on the β decay of Pa^{233}. This work removes some of the ambiguities between previous coincidence work and the previously proposed decay scheme. ***John P. Unik.*** *U. S. Atomic Energy Commission, UCRL-9105,* Mar. 1960, 105 pp. (UF767 U3u Contin.)

10780 Table of the Incomplete Gamma Function. The $I(u,p)$ function is tabulated for odd-integer values of the argument p ranging from 1 to 13, and for increments of 0.01 of the argument u ranging from 0.00 to 10.00. The values of $I(u,p)$ are listed to eight decimal places with an accuracy of ± 1 in the seventh decimal place. The calculations were performed by an IBM-650 electronic digital computer using single precision floating–point arithmetic and logarithms. ***J. R. Walton, T. Sikkeland, A. Ghiorso, and G. T. Seaborg.*** *U. S. Atomic Energy Commission, UCRL-9107,* Mar. 1, 1960, 25 pp. (UF767 U3u Contin.)

10781 Paramagnetic Resonance of Tetravalent Pa^{231}. A melt of Cs_2 Zr Cl_6 was doped with $\sim$ 500 μgms of anhydrous Pa^{231} Cl_4 and allowed to crystallize in an atmosphere of H by

slow passage through a furnace. At 4 K the observed resonance pattern consisted of four widely separated hyperfine components. The nuclear-spin assignment of 3/2 is verified. The paramagnetism can be most plausibly ascribed to a single 5f electron. A magnetically isotropic Kramer's doublet is expected to be the lowest lying as the result of the octahedral perturbation present in a Zr site. As an alternative, a 6d′ configuration is expected to give rise to a four-fold degenerate magnetically anisotropic level if octahedral symmetry is preserved, or an anisotropic doublet if distortion is present. ***Ru-Tao Kyi.*** *U. S. Atomic Energy Commission, UCRL*-9109, Mar. 4, 1960, 66 pp. (UF767 U3u Contin.)

10782 The Elastic Scattering of Negative Pions by Protons at 230, 290, 370, and 427 Mev. The elastically scattered pions were detected by a counter telescope which discriminated against recoil protons and inelastic pions on the basis of their shorter ranges. Nine differential-cross-section points obtained at each energy were fitted by a least-squares program to a Lengendre polynomial series. At the three higher energies, D waves are required to give a satisfactory fit to the data. The real part of the forward-scattering amplitudes calculated from this experiment are in agreement with the predictions of dispersion theory. The results of this experiment in conjunction with data from other pion-nucleon scattering experiments support charge independence at these higher energies. ***Lester K. Goodwin.*** *U. S. Atomic Energy Commission, UCRL*-9119, Apr. 7, 1960, 84 pp. (UF767 U3u Contin.)

10783 The Rubidium-85-Rubidium-86 Hyperfine-Structure Anomaly. The atomic-beam magnetic-resonance method with separated oscillatory fields has been used to measure the hyperfine-structure separation and magnetic dipole moment of the isotopes Rb^{85} and Rb^{86}. Observation of a $\Delta F = \pm 1$ doublet in the magnetic field region where its mean value is a minimum gives the values of these observables; the doublet separation is proportional to the nuclear g factor and the mean doublet frequency is proportional to the hyperfine-structure separation. Results obtained on Rb^{85} are in excellent agreement with previously published values, and indicate that the transition frequencies calculated from the Breit-Rabi energy-level equation agree with the experiment to better than one part per million. Details of the apparatus constructed for the purpose of measuring these anomalies in radioactive alkali isotopes are presented, as well as the comparison of the experimental result with values predicted for the anomaly by using various nuclear models and the Bohr-Weisskopf theory. ***Norman Braslau.*** *U. S. Atomic Energy Commission, UCRL*-9130, Mar. 21, 1960, 150 pp. (UF767 U3u Contin.)

10784 Technical Progress Report. Pressurized Water Reactor (PWR) Project for the Period February 24, 1960 to April 23, 1960. *U. S. Atomic Energy Commission, WAPD-MRP*-85, 122 pp. (UF767 Un3.1wa Contin.)

10785* Measurement of Cobalt-60 and Cesium-137 Gamma Rays With a Free-Air Chamber. Design data for free-air chambers cobalt-60 and cesium-137 gamma rays in roentgens are presented. It has been shown that the Jaffé-Zanstra method of obtaining the saturation current is adequate for air pressures of about 4 to 12 atmospheres. ***H. O. Wyckoff.*** *U. S. National Bureau of Standards, Journal of Research, Section C, Engineering and Instrumentation,* v. 64C, no. 2, Apr.-June 1960, p. 87-97.

10786* Internal Conversion Pairs in the Decay of Neutral π-Mesons. Twenty-seven charge-exchange scattering events with subsequent decay $\pi^0 \rightarrow e^- + e^+ + \gamma$ were recorded in a H-filled diffusion cloud chamber located in a magnetic field and operating in 128 MeV and 162 MeV negative π-meson beams. The probability of this decay relative to that for the usual decay is found to equal 0.0117 ± 0.0015 (*In Russian.*) Pary vnutrenneĭ konversii pi raspade neĭtral'nogo π-mezona. ***Iu. A. Budagov, S. Viktor, V. P. Dzhelepov, P. F. Ermolov, and V. I. Moskalev.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki,* v. 38, no. 4, Apr. 1960, p. 1047-1052.

10787* Fragment Production by 100 MeV Protons. The fragmentation cross section on heavy nuclei of the emulsion is (1.93 ± 0.64) *mb* and (1.16 ± 0.36) *mb* on light nuclei. Energy and angular characteristics of the process have been obtained. Some arguments are presented which support the assumption that for $E = 100$ MeV multicharged fragments are produced in quasielastic scattering of nucleon complexes of the nucleus. (*In Russian.*) Obrazovanie fragmentov pod deĭstviem protonov s energieĭ 100 MeV. ***U. R. Arifkhanov, M. M. Makarov, N. A. Perifilov, and V. P. Shamov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki,* v. 38, no. 4, Apr. 1960, p. 1115-1122.

10788* Polarization Effects in the Scattering of Electrons on Deuterons. The differential cross section and change in electron polarization which occurs when polarized deuterons are disintegrated by polarized electrons are calculated with account of electromagnetic nucleon formfactors. An expression is also derived for the polarization of recoil deuterons in elastic scattering of polarized electrons on unpolarized deuterons. (*In Russian.*) Poliarizatsionnye effekty pri rasseianii elektronov na deĭtronakh. ***G. V. Frolov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki,* v. 38, no. 4, Apr. 1960, p. 1148-1152.

See also: **10385** (nuclear methods in oil prospecting); **10532** (corrosion in organic reactor coolants); **10704** (properties of stainless steel-UO_2 fuel elements).

OPERATIONS RESEARCH

10789* The Consolidated Functions Concept. A management nerve center provides an integrated method of operation and centralized control of decentralized operations. ***Al N. Seares.*** *Advanced Management,* v. 25, June 1960, p. 22-28.

10790 Authority and Organization in German Management. German management in perspective, general management, management and the trade unions, the development of leadership, and the associations and ascendancy of business are discussed. ***Heinz Hartmann.*** 318 pp. 1959. Princeton University Press, New Jersey. (HD70.G2 H25a)

10791* Dynamic Inventory Policy With Varying Stochastic Demands. A dynamic inventory model is formulated in which the demand distributions may change from period to period. The optimal policy at each stage is characterized by a single critical number which also could vary in successive periods. ***Samuel Karlin.*** *Management Science,* v. 6, no. 3, Apr. 1960, p. 231-258.

10792* Linear Programming and Sequential Decisions. Using an illustration drawn from the area of inventory control, this paper demonstrates how a typical sequential probabilistic model may be formulated in terms of an initial decision rule and a Markov process, and then optimized by means of linear programming. ***Alan S. Manne.*** *Management Science,* v. 6, no. 3, Apr. 1960, p. 259-267.

10793* Leader Authoritarianism and Employee Attitudes. The relationship between the authoritarianism of supervisors and the attitudes of their subordinates has been studied in two different operations within a single industrial organization. The findings support a situational approach to leadership and suggest that the effectiveness of democratic leadership depends greatly upon the interdependence of the work group and restraints on interaction between supervisor and subordinates. ***Victor H. Vroom and Floyd C. Mann.*** *Personnel Psychology,* v. 13, no. 2, Summer 1960, p. 125-140.

10794* Predicting Managerial Effectiveness. Results of this study suggest that there exists a phenomenon of general managerial effectiveness which runs through various managerial assignments and which can be identified regardless of the individual manager's assignment. The prediction method developed in this study should be applicable in a wide variety of managerial staffing situations as a screening device. ***Thomas A. Mahoney, Thomas H. Jerdee, and Allan N. Nash.*** *Personnel Psychology,* v. 13, no. 2, Summer 1960, p. 147-163.

10795* Predicting Success for Young Executives From Objective Test Scores and Personal Data. On the basis of this finding it would appear that standard psychometric measures do not discriminate significantly enough within a group of executives, and that further research utilizing other techniques, perhaps the projective variety, would be called for. ***Edwin E. Wagner.*** *Personnel Psychology,* v. 13, no. 2, Summer 1960, p. 181-186.

10796* The Bottleneck in Effective Personnel Appraisal: Identifying What Is Limiting and Why. The author points out that appraisers themselves should be good researchers. ***A. F. Kaulakis.*** *Research Management*, v. 3, no. 1, Spring 1960, p. 5-12.

10797* Long-Range Manufacturing Planning Crystal Ball or Computer? Using a technique called "business simulation", computers can be used to determine the effects of alternative plans. ***Leonard Kranser.*** *Tool Engineer*, v. 44, no. 7, June 1960, p. 73-77.

ORE AND MATERIALS BENEFICIATION

10798* Ore Dressing . . . . Developments in Australia . . . . 1959. I. Crushing and Screening, Grinding and Classification, Flotation, Filtering and Thickening. A review. ***J. T. Woodcock.*** *Chemical Engineering and Mining Review*, v. 52, no. 6, Mar. 15, 1960, p. 62-69.

10799* How a Difficult Chalcopyrite-Pyrite Separation Was Made by Flotation. Sodium sulfite and lime, rather than NaCN and lime, are used to depress the pyrite. ***William Rogers Wade.*** *Mining World*, v. 22, no. 7, June 1960, p. 34-36.

10800 The Origin of Ores. Metals most commonly found in the world's ores are not necessarily the most abundant. Natural processes have concentrated some metals more than others. ***H. G. Bachmann.*** *Scientific American*, v. 202, no. 6, June 1960, p. 146 + 7 pages.

10801* Mechanism of Mineralizing Process During Production of Fluxed Sinter. Investigation of the process, occurring in sintering mixtures, enabled the optimum metallurgical properties of the fluxed sinter and the process of its production to be established. (*In Russian.*) Mekhanizm mineraloobrazovaniia pri spekanii ofliusovannogo aglomerata. ***D. A. Kissin and T. I. Kitvinova.*** *Stal'*, v. 20, no. 5, May 1960, p. 397-403.

10802* Combined Method of Complex Treatment of High-Silicon and High-Ferrous Bauxites Containing Titanium. Permits extraction of 96-97% Al_2O_3, 98% Fe and ~ 100% Ti with up to 80% alkali regeneration from the slime. Provides for intensification of the treatment of bauxite by using, for lixiviation, high modulus aluminate solutions and a deeper precipitation of alumina from the mother liquor after centrifuging the crystallization of sodium aluminate. (*In Russian.*) Kombinirovannyĭ sposob kompleksnoĭ pererabotki vysokokremnistykh i vysokozhelezistykh boksitov, soderzhashchikh titan. ***V. D. Ponomarev, L. P. Pi, and V. S. Sazhin.*** *Tsvetnye Metally*, v. 30, no. 5, May 1960, p. 44-48.

See also: **10395** (mineral dressing flowsheets).

PHYSICS

10803* A Unified Program for Phase Determination, Type $3P_2$. The unified program for phase determination, valid for all the space groups and both the equal and unequal atom cases, is contained here. The present paper is concerned with the centrosymmetric space groups comprising type $3P_2$. A detailed procedure for phase determination is described for this type. ***J. Karle and H. Hauptman.*** *Acta Crystallographica*, v. 13, pt. 6, June 10, 1960, p. 469-476.

10804* Slit Height Corrections in Small Angle X-Ray Scattering. A method of correcting experimental small angle X-ray scattering curves for the effects of the height of the collimating slits is developed. The method has the advantage of eliminating the need for numerical differentiation of the experimental curve. ***Paul W. Schmidt and Robert Hight, Jr.*** *Acta Crystallographica*, v. 13, pt. 6, June 10, 1960, p. 480-483.

10805 The Rotation of Liquid Helium II. The quantization of circulation, uniformly rotating helium II, the observable properties of vortex lines, superfluid turbulence are discussed. ***H. E. Hall.*** *Advances in Physics*, v. 9, no. 33, Jan. 1960, p. 89-146.

10806* A Contribution to the Problem of Interpretation of Radiographic Spectra. The change of the electron density in the region of the K-envelope of atoms because of the change of the external shielding by valence electrons during variations of the chemical bond has no effect practically on the K-level. The changes in the position of the $K\beta_{2,2}$ lines ($Z = 20 \div 29$) of the atoms in compounds within the limits of one type of bond are determined in the basic change of the number of valence d-electrons. (*In Russian.*) K voprosu ob interpretatsii rentgenovskikh spektrov. ***A. T. Shuvaev.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia*, v. 24, no. 4, Apr. 1960, p. 424-427.

10807* Functional Relationship With Direction in Magnetostriction. In single crystals magnetostriction can be described by means of a symmetrical two stage tensor with components depending on the direction of magnetostriction. With the aid of a group theory method for all classes of crystals, the functional relationship is expressed by a form sufficing for the crystal symmetry. These results can be applied not only to magnetostriction, but for instance to the resistance in magnetic single crystals and in the theory of the lattice oscillations. (*In German.*) Die Richtungsabhängigkeit der Magnetostriktion. ***W. Döring and G. Simon.*** *Annalen der Physik*, v. 5, nos. 7-8, Mar. 1960, p. 373-387.

10808* A Contribution to the Study of Diffraction in Electromagnetic Waves by the Spheres. A study covering the mathematic theory of this type of diffraction, the diffraction processes caused near the axis by a sphere isolated in space, the effetcive radar sections of this latter type of sphere, the interaction of two neighboring spheres placed in an electromagnetic field, and the diffraction near the axis by conducting bodies near the spheres. (*In French.*) Contribution a l'étude de la diffraction des ondes électromagnétiques par les sphères. ***Jean Mével.*** *Annales de Physique*, v. 5, ser. 13, nos. 3-4, Mar.-Apr. 1960, p. 265-320.

10809* The Shape of the Rays in Paramagnetic Resonance and the Direct Measurement of the Moments. The klystron feeding the spectrograph according to the Pound arrangement was stabilized. Two new methods were devised to measure the moment of a ray and were accounted for theoretically in practice. They were applied to the study of coal, revealing the possible application of the measurement of the moments to the quantitative determination of the paramagnetic centers, and to the study of manganese sulfate. (*In French.*) La forme des raies en résonance paramagnétique et la mesure directe des moments. ***Jacques Hervé.*** *Annales de Physique*, v. 5, ser. 13, nos. 3-4, Mar.-Apr. 1960, p. 321-364.

10810* A Contribution to the Study of the Excitation of Phosphorescence by Infrared. The excitation spectra of different phosphorescent bodies such as SrS, ZnS, etc., were studied and the depths of the traps existing in these bodies were determined as well as the decline of the thermoluminescence curves produced by a preliminary infrared radiation and the decrease of the excitation spectrum after a delay or a preliminary heating process. Several hypotheses are considered in order to describe the effects of I.R. on the ZnS and the sensitizing role of lead. (*In French.*) Contribution a l'étude de la stimulation de la phosphorescence par l'infra-rouge. ***Germaine Curie.*** *Annales de Physique*, v. 5, ser. 13, nos. 3-4, Mar.-Apr. 1960, p. 365-408.

10811* Experimental Study of the Dielectric Constant Variations Connected With a Phase Change. Three groups of bodies were studied in which the processes are distinct: ammonium sulfate, ammonium alums and ferroelectrics of the PO_4H_2K group. In the last case, transition temperatures were determined and a new form of absorption was shown, causing maxima in the ϵ'' (T) curve whose temperature is independent from the frequency of measurements. (*In French.*) Étude expérimentale des variations de la constante diélectrique liées a un changement de phase. ***Serge le Montagner.*** *Annales de Physique*, v. 5, ser. 13, nos. 3-4, Mar.-Apr. 1960, p. 469-508.

10812* Ionic Cyclotron Resonance in Dense Plasmas. In plasmas with a charge particle density of 10^7 - 10^{11} cm^{-3} the use of short heating sections permits a decrease of the effect of the transversal ionic fields of polarization because of the motion of the charge electrons along the lines of force of the external magnetic field. In a plasma with a low degree of ionization, there is a strong decrease of the efficiency of energy transfer.

(*In Russian.*) Ionnyĭ tsiklotronnyĭ rezonans v plotnykh plazmakh. ***L. V. Dubovoĭ, O. M. Shvets, and S. S. Ovchinnikov.*** *Atomnaia Energiia*, v. 8, no. 4, Apr. 1960, p. 316-323.

10813 Available Energy and the Second Law Analysis. This text is concerned with the development and use of the concept of available energy. The first two chapters are discourses on the first and second law of thermodynamics and the remainder is devoted to the available energy concept. ***Edward A. Bruges.*** 124 pp. 1959. Academic Press Inc., New York. (TJ265 B83a)

10814* Cryogenics. Low-Temperature Research and Engineering. A survey of developments in cryogenic engineering. ***K. Mendelssohn.*** *Chemical & Process Engineering*, v. 41, June 1960, p. 233 + 4 pages.

10815* Magnetism. Effect on the Porosity on the Width of the Absorption Curve of Pure Yttrium Garnet and of Garnet, Where Yttrium Is Substituted by Cr and Al. The width ΔHa of the resonance curve diminishes with the porosity of the garnet, and of the garnet where Yb is substituted by Cr or Al. At an equal porosity Al decreases the ΔHa, but Cr increases the ΔHa. (*In French.*) Magnétisme. Influence de la largeur de la courbe d'absorption du grenat d'yttrium pur et substitué par Cr et Al. ***Roger Vautier and André-Jean Berteaud.*** *Comptes Rendus Hebdomardaires des Séances de L'Académie des Sciences*, v. 250, no. 10, Mar. 7, 1960, p. 1812-1814.

10816* On the Application of the Method of Oblique Incidence in Photoelasticity. It is assumed that by oblique incidence retardation values as well as parameters of isoclinics are determined. The application of the universal stage of Fedorov is considered. The application of the oblique incidence method with the shear-difference method and with mechanical strain measurement in separating principal stresses has been studied. (*In Russian.*) O primenenii metoda naklonnogo prosvechivaniia v fotouprugosti. ***Kh. Aben.*** *Eesti NSV Teaduste Akadeemia Toimetised. Tehniliste ja Füüsikalis-Matemaatiliste Teaduste Seeria*, 1960, no. 1, p. 33-46.

10817 Instrumentation for Plasma Propulsion. Use of plasma as a means of propelling vehicles through space appears promising. Creating and investigating plasmas in the lab require unique instrumentation to get data. ***J. J. Pearson.*** *Electronics*, v. 33, no. 24, June 10, 1960, p. 66-69.

10818 Elementary Statistical Physics. Fundamental principles of statistical mechanics, fluctuations, noise and irreversible thermodynamics, kinetic methods and transport theory are discussed. ***C. Kittel.*** 228 pp. 1958. John Wiley & Sons, New York. (QC175 K65e)

10819* On the Theory of a Plasma-Thermoelement. Physical processes in a plasma-thermoelement are discussed: (a) at a local thermodynamic equilibrium, (b) at an ignoration of the generation and recombination by volume. It is shown that in the second case, which evidently is of the most practical interest, the current is determined by the diffusion of the carriers, but the voltage on the load is chiefly determined by the contact difference of the potentials. (*In Russian.*) K teorii plazmennogo termoelementa. ***B. Ia. Moĭzhes and G. E. Pikus.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 756-774.

10820* Nonlinear Processes in a Plasma in a Variable Electromagnetic Field. A study of the plasma in a homogeneous electric field from the point of view of the elementary theory with a description of the nonlinear effects in the propagation of radiowaves in a plasma in the ionosphere, of the results of experimental investigations of the cross modulation in the ionosphere and of the nonlinear alternating effects of nonmodulated radiowaves. (*In German.*) Nichtlineare Erscheinungen in einem Plasma, das sich in einem veränderlichen elektromagnetischen Feld befindet. ***V. L. Ginzburg and A. V. Gurevič.*** *Fortschritte der Physik*, v. 8, no. 3, 1960, p. 1-189.

10821* Design and Operation of a Molecular Oscillator. Theoretical implications of the design of a two-level maser of the molecular-beam type are presented. The design and operation of a microwave maser that employs a beam of ammonia molecules are described. ***H. G. Venkates and M. W. P. Standberg.*** *Indian Academy of Sciences, Proceedings*, v. 51, sec. A, no. 3, Mar. 1960, p. 123-136 + 1 plate.

10822* Electronic Transition Moment Variation in ($B^1\Sigma \rightarrow X^1\Sigma$) Bands of BeO. Accurate integrated intensity data of the bands of BeO ($B^1\Sigma \rightarrow X^1\Sigma$) system has been obtained experimentally by the technique of photographic photometry. With the use of Franck-Condon factors and r-centroids for the bands available from the work of the authors reported in papers elsewhere, the relation of electronic transition moment R_e with internuclear separation r, has been evolved. ***N. R. Tawde and N. Sreedhara Murthy.*** *Indian Academy of Sciences, Proceedings*, v. 51, sec. A, no. 4, Apr. 1960, p. 219-231.

10823 The Forms of the Relative Partial Molar Thermodynamic Functions in Solid Binary and Ternary Systems. The changes in the relative partial molar thermodynamic functions on crossing phase boundaries in binary and ternary systems are derived, and it is suggested that the analysis may be of value in checking doubtful experimental data. ***F. H. M. Videira and B. B. Argent.*** *Institute of Metals, Journal*, v. 88, pt. 8, Apr. 1960, p. 379-380.

10824* Heat Conductivity of Certain Dielectrics in Electric Field. On the basis of experiments it is shown that an intensive exchange of heat is possible in an electric field between the upper layers of certain dielectric liquids heated to a higher temperature and the cooler bottom layers. (*In Russian.*) O teploprovodnosti nekotorykh dielektrikov v elektricheskom pole. ***I. E. Balygin.*** *Inzhenerno-Fizicheskiĭ Zhurnal*, v. 3, no. 3, Mar. 1960, p. 54-58.

10825* The Calculation of Optical Properties of the Bottom of a Series of Plane Parallel Layers. By means of a complex Fourier transformation an exact solution is found for Maxwell equations for the determination of various absorbing and nonabsorbing layers where the indicent light ray is perpendicular. For the case of an incident flat wave, finite formulae are deduced for the reflected and traversing light. (*In Russian.*) Raschet opticheskikh svoistv stopy ploskoparallel'nykh sloev. ***A. P. Khapalyuk.*** *Inzhenerno-Fizicheskiĭ Zhurnal*, v. 3, no. 3, Mar. 1960, p. 59-68.

10826* The Acceleration of a Plasma Cluster When Passing Through Nonuniform Electromagnetic Field. A general expression for the neutralized force, conditioned by the reaction of a field with an electrical dipole moment of the cluster and possibilities to accelerate the cluster in the fields of the traveling and standing waves were found. A multicascade acceleration in systems with alternating regions of low or high uniform fields is difficult due to the presence of "classifiers" of the plasmas in polarizations and speeds. (*In Russian.*) Ob uskorenii plazmennogo sgustka pri prokhozhdenii cherez neodnorodnoe elektromagnitnoe pole. ***V. B. Gil'denburg and M. A. Miller.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Radiofizika*, v. 3, no. 1, 1960, p. 97-101.

10827* Investigation of the Absorption of Coherent Radiation in Magnetic Nuclear Resonance. First calculates the shape of absorption or emission lines in N. M. R. when the damping by coherent radiation is considerable. Passages by resonance sweeping the magnetic director field or frequency are not equivalent and are studied separately. (*In French.*) Étude de l'amortissement par rayonnement cohérent en résonance magnétique nucléaire. ***Henri Benoit.*** *Journal de Physique et le Radium*, v. 21, no. 4, Apr. 1960, p. 212-216.

10828* Calculation of the Diamagnetic Coefficient of Free Atoms. Starting from first ionization energies of atoms, a screening effect is determined, which is then corrected for the experimental "screen jumps". This corrected screen effect enables, without modification of the principal quantum numbers, the diamagnetic mass susceptibility of free atoms to be computed. (*In French.*) Sur le calcul du coefficient diamagnétique des atomes libres. ***Clément Courty.*** *Journal de Physique et le Radium*, v. 21, no. 4, Apr. 1960, p. 233-241.

10829 Papers Presented at the Conference of Magnetism and Magnetic Materials, Detroit, Michigan, November 16-19, 1959. *Journal of Applied Physics* (Supplement), v. 31, May 1960, 420 pp.

10830 Electrical Stability and Life of the Heated Field Emission Cathode. The cold tungsten field cathode exhibits electrical stability and long life (12,000 hr demonstrated) at dc emission densities up to $10^7/cm^2$, when operated in vacuum tubes with a residual gas pressure below 10^{-12} mm Hg; with a

provision for periodic reconditioning of the cathode surface by a brief flash heating, satisfactory operation of the cold cathode may be achieved at tube pressures up to about 10^{-9} mm Hg. Continuous heating of the field cathode is shown to yield useful electrical stability at conventional tube pressures, e.g., 10^{-8} mm Hg. ***W. P. Dyke, et al.*** *Journal of Applied Physics*, v. 31, May 1960, p. 790-805.

10831 Scattering of a Plane Transverse Wave by a Spherical Obstacle in an Elastic Medium. The scatterer is taken to be (a) a cavity, (b) a rigid sphere, (c) a fluid-filled cavity, and (d) to consist of an elastic material with properties different from those of the surrounding material. The problems are carried as far as possible analytically without approximations and are reported as matrix equations. The solution of these equations yields the expansion coefficients that describe the waves which are scattered outward from the obstacle and which are excited within the scatterer. A general expression for the scattering cross section offered to a transverse wave has been derived. The Rayleigh approximation is then considered in detail for three of the cases. ***Norman G. Einspruch, E. J. Witterholt, and Rohn Truell.*** *Journal of Applied Physics*, v. 31, May 1960, p. 806-818.

10832 Thermal Positive Ion Emission and the Anomalous Flicker Effect. The correlation between the anomalous flicker effect in space charge limited diodes and the positive ion pulses which generate it is studied in the light of recent measurements of the size and shape of thermal positive ion pulses from tungsten filaments. It is shown that the positive ion pulses, although smaller than the electron pulses, have similar duration times, and that the periodic structure of the electron pulses may be quantitatively explained by reflection of the positive ion bursts back and forth through the region of maximum space charge. ***S. Datz, R. E. Minturn, and E. H. Taylor.*** *Journal of Applied Physics*, v. 31, May 1960, p. 880-883.

10833 Ultrasonic Viscoelastic Properties of Associated Liquids. Measurements of ultrasonic propagation of longitudinal and shear waves over a wide frequency and temperature range were made in an homologous series of associated liquids, butanediol 1,3,2-methyl pentanediol 2,4 and hexanetriol 1,2,6. ***R. Meister, C. J. Marhoeffer, R. Sciamanda, L. Cotter, and T. Litovitz.*** *Journal of Applied Physics*, v. 31, May 1960, p. 854-870.

10834 Evolution of Gases and Ions From Different Anodes Under Electron Bombardment. With the aid of a bakeable mass spectrometer a study has been made of the material evolved from Ag, Cu, Ni, Mo, Ta, Ti, and W anodes exposed to oxide cathodes. Chlorine was found to be evolved from all the anodes during the first period of bombardment. No evidence of the dissociation of the thin films of BaO or SrO on the anodes was obtained, suggesting it does not play a significant role in oxide cathode poisoning. It is believed that the Cl evolution may be responsible for the early slump in emission commonly observed at low anode voltages from oxide cathodes. Evolution of 0^+ ions was observed from oxidized Cu, Ni, Mo, Ta, and Ti with efficiencies up to approximately 10^{-5} ions/electron for electron energies of 90 ev and current densities of 10 ma/cm^2. This 0^+ evolution reduced considerably the dc emission capabilities of the oxide cathodes. It was found that heating the anodes from 700 to 1000 C for long periods of time does not always eliminate all evolution products caused by electron bombardment. Hydrogen was observed to be evolved from Ti and 0^+ ions were observed from formerly oxidized Cu, Ni, Mo, and Ta immediately after outgassing at temperatures less than 1000 C. ***J. R. Young.*** *Journal of Applied Physics*, v. 31, May 1960, p. 921-923.

10835 Interactions Between Molecules Adsorbed on a Surface. The two-molecule-surface potential is derived from quantum mechanical third-order perturbation theory. It is shown that this potential consists of two parts just as the energy giving the van der Waals attraction of a single molecule to a surface does. ***Oktay Sinanoglu and Kenneth S. Pitzer.*** *Journal of Chemical Physics*, v. 32, May 1960, p. 1279-1288.

10836 Calculation of the Coupling Terms Neglected in Performing the Born-Oppenheimer Separation for the Hydrogen Molecule Ion. A method is given for calculating the coupling between the nuclear and electronic motion in the H molecule ion using the exact wave functions. Calculations are carried out for the transition $1s\sigma$-$2s\sigma$ and compared with values obtained from simple approximate methods. Estimates are made of the cross sections for excitation and capture into the $2s$ state during a proton-hydrogen atom collision. ***Donald W. Jepsen and Joseph O. Hirschfelder.*** *Journal of Chemical Physics*, v. 32, May 1960, p. 1323-1335.

10837 Thermodynamic Excess Functions for Electrolyte Solutions. A system of excess functions is developed for electrolyte solutions and other solutions with an essentially unsymmetrical solvent-solute relation. These new functions vanish for a solution whose practical (molal scale) osmotic coefficient is unity at all compositions, temperatures, and pressures. ***Harold L. Friedman.*** *Journal of Chemical Physics*, v. 32, May 1960, p. 1351-1362.

10838 Theory of Saturation in Electron Spin Resonance Spectra. A theory of saturation in electron spin resonance spectra exhibiting hyperfine splitting is presented. This theory is used to study the saturation of free radical spectra in solution, and a variety of relaxation processes are investigated. It is shown that motional modulation of the intramolecular electron-nuclear anisotropic dipole-dipole interaction introduces a relation between the saturation parameters and the hyperfine components. ***Michael J. Stephen and George K. Fraenkel.*** *Journal of Chemical Physics*, v. 32, May 1960, p. 1435-1444.

10839* Group Tensor Spaces. A new method to obtain tensors of a given symmetry by constructing them from some basic tensors is explained. The number of basic tensors and their individual symmetry are given as well as tables of space dimensions, more detailed than published so far. (*In Russian.*) Gruppovye tenzornye prostranstva. ***Iu. I. Sirotin.*** *Kristallografiia*, v. 5, no. 2, 1960, p. 171-179.

10840* Atomic Structure of $RuSb_2$ and $OsSb_2$. Alloys of Ru and Os with Sb were studied radiographically and microscopically. In the Ru-Sb two compounds were found: $RuSb_2$ and RuSb. When Os is melted with Sb, $OsSb_2$ is formed. $RuSb_2$ and $OsSb_2$ are isomorphous with $FeSb_2$ and are structurally related to marcasite. Thickness and microhardness were determined. RuSb was assumed to be related structurally to MnP. (*In Russian.*) Atomnaia struktura $RuSb_2$ and $OsSb_2$. ***R. N. Kuz'min, N. N. Zhuravlev, and S. A. Losievskaia.*** *Kristallografiia*, v. 5, no. 2, 1960, p. 218-223.

10841* Investigation of the Distribution of the Molecules of an Impurity in the Solid Solutions of Organic Materials. Two different types of distribution of the impurity molecules were revealed by radiostructural investigation. In the case of true solubility, crystals of solid solutions of substitution, the elementary cell of which considerably increases with the increase in the concentration of the impurity, were observed. The dimensions of the elementary cell do not change much in the case of "interblock" solubility. (*In Russian.*) Issledovanie raspredeleniia molekul primesi v tverdykh rastvorakh organicheskikh veshchestv. ***A. I. Kitaĭgorodskiĭ and R. M. Miosnikova.*** *Kristallografiia*, v. 5, no. 2, 1960, p. 247-252.

10842* Radiographic Investigation of the $BaNb_2O_6$ - $CaNb_2O_6$ and $BaNb_2O_6$ - $SrNb_2O_6$ Systems. In determined concentrations of $CaNb_2O_6$ and $SrNb_2O_6$, solid solutions of $BaNb_2O_6$ - $CaNb_2O_6$ and $BaNb_2O_6$ - $SrNb_2O_6$ were observed. The functional temperature relationship of the parameters of the lattices was studied. There is a ferroelectric phase transition of Cm2m (rhombic)$_{Tk}$ $\rightleftarrows$ P_4/mbm (tetragonal.) (*In Russian.*) Rentgenograficheskoe issledovanie sistem $BaNb_2O_6$ - $CaNb_2O_6$ and $BaNb_2O_6$ - $SrNb_2O_6$. ***I. G. Ismailzade.*** *Kristallografiia*, v. 5, no. 2, 1960, p. 268-272.

10843* Determination of the Boron Concentration in Gaseous Mixtures With the Help of Neutron Points. The α-particles from the reaction $B^{10}(n,\alpha)Li^7$ are easily recorded by means of an ionization chamber with complementary electrodes which increase the gradient of the electric field in the chamber and decrease the columnar recombination negatively affecting the graduated curve. The concentration of BCl_3 in a mixture with H between 0.5 and 75% or of B from 0.046 to 7.02% with a respective error of $\pm 5\%$ and $\pm 20\%$. (*In Russian.*) Opredelenie kontsentratsii bora v gazovykh smesiakh pri pomoshchi neĭtronnykh puchkov. ***Ia. Chudars, I. Taure, I. Mednis, O. Veveris.*** *Latvijas PSR Zinātnu Akademiias Vestis*, 1960, no. 3, (152), p. 57-64.

10844 Matter, Earth, and Sky. Matter at first sight, the laws of mechanics, elastic vibrations and waves, heat and temperature, electromagnetism, light, modern views on space, time, and motion; microcosm: restless molecules, basic laws of chemistry, inorganic family album; macrocosm: our solid earth, the book of sediments, ocean of water and ocean of air, the planetary system, and our sun are discussed. ***George Gamow.*** 593 pp. 1958. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. (QC171 G14m)

10845* An Interpretation of Potential Interaction Constants in Terms of Low-Lying Excited States. This paper examines the use of second-order perturbation theory in the interpretation and prediction of the signs of the interaction constants which are appended to the simple valence force potential functions. It is shown, for the large number of molecules considered here, that complete agreement with the observed signs can be obtained by expanding the electronic Hamiltonian in terms of the normal coordinates of motion. ***R. F. W. Bader.*** *Molecular Physics,* v. 3, no. 2, Mar. 1960, p. 137-151.

10846* Studies of Ion-Solvent and Ion-Ion Interactions Using Nuclear Magnetic Resonance Spectroscopy. Chemical shifts of the fluorine nuclear resonance have been measured for fluoride ion in a variety of environments. The shift varies linearly with the mole-fraction of organic solvent and is dependent upon the nature and concentration of added cations and anions. In contrast, the value for the caesium resonance from solutions of caesium salts is independent of the choice of solvent. ***A. Carrington, F. Dravnicks, and M. C. R. Symons.*** *Molecular Physics,* v. 3, no. 2, Mar. 1960, p. 174-182.

10847* The Effect of Strong Electric ad Magnetic Fields on the Depolarization Ratios of Gases. The influence of a strong electric field F on the polarization of light scattered elastically by small gaseous molecules is investigated. Two effects are found. The field distorts the molecules, thereby changing their polarizabilities. If they are isotropically polarizable when $F=0$, and hence capable of scattering only polarized light from a parallel beam, this distortion may lead to depolarization. F tends to orientate anisotropic molecules, thereby affecting the polarization of the scattered light. ***A. L. Andrews and A. D. Buckingham.*** *Molecular Physics,* v. 3, no. 2, Mar. 1960, p. 183-189.

10848 Preliminary Flight Tests of an Atomic Clock in Preparation of Long-Range Clock Synchronization Experiments. Synchronization of remote clocks by means of a shuttle plane is entirely feasible, and that, even with existing equipment, such synchronization will be about a thousand times more accurate than that at present possible through use of radio time signals. ***Friedrich H. Reder and Gernot M. R. Winkler.*** *Nature,* v. 186, May 21, 1960, p. 592-593.

10849 New Ray Tracing Scheme. A detailed theoretical treatment is given of a new algebraic ray tracing scheme for tracing rays from an object point through any axially symmetrical optical system, including catadioptric systems, which contain spherical surfaces only. An explanation is given of the coordinate systems used which effect considerable simplifications both in the theory and its application. Gives a fully worked example of a skew ray trace through a wide angle system. An electronic computer has been programmed for this ray trace and details are given. A predetermined scan interval is given to the machine which then proceeds automatically to trace from an object point rays spaced at this interval over the first polar tangent plane. For pencils of all obliquities, vignetting is carried out by the machine, which produces as one of the results the apparent shape of the entrance pupil. ***P. W. Ford.*** *Optical Society of America, Journal,* v. 50, June 1960, p. 528-533.

10850 On the Theory of Formation of Latent Electrophotographic Images on Photoelectrets. The process of formation of persistent internal photopolarization in crystals is considered on the basis of the band theory. The results obtained may be used in analyzing the process of formation of latent electrophotographic images. ***V. M. Fridkin.*** *Optical Society of America, Journal,* v. 50, June 1960, p. 545-550.

10851 Thermodynamic Limitation on the Conversion of Heat Into Light. The problem of converting ambient heat into luminescence radiation is analyzed in terms of the thermodynamics of the electromagnetic field. The process is described in terms of the technical efficiency of a light source η, defined as the ratio of the power leaving the source in the form of luminescence radiation to the power supplied to the source in the form of work. For a source at the ambient temperature T, it is shown that the limitation imposed by thermodynamics is, in the steady state, $\eta \leq 1+T/(T_r-T)$, where T_r is the ratio of the net rate at which the field carries energy away from the source to the net rate at which the field carries entropy away from the source as a result of the luminescence emission. Thus, $T/(T_r-T)$ is the maximum possible contribution of ambient heat to the technical efficiency of a light source. ***M. A. Weinstein.*** *Optical Society of America Journal,* v. 50, June 1960, p. 597-602.

10852 Helium Level Populations in a Glow Discharge. Spectral line intensities of a helium glow-discharge plasma were measured, and relative populations of the excited levels were calculated for various pressures from 0.842 to 2.83 mm Hg and currents from 3 to 40 ma. ***William J. Condell, Jr.*** *Optical Society of America, Journal,* v. 50, June 1960, p. 610-616.

10853 Absorption by Infrared Bands of Carbon Dioxide Gas at Elevated Pressures and Temperatures. Experimental data and empirical correlations for the total absorption of band groups at 15, 10.4, 9.4, 7.5, 5.2, 4.8, 4.3, 2.7, 1.6, and 1.4μ are presented for carbon dioxide gas in nitrogen at total pressures from 0.5 to 10 atm, temperatures from 294 to 1390 K (530 to 2500 R) and mole fractions from 0.05 to 1.00. The data were obtained from low-resolution measurements of the spectral absorptivity. Use of optical paths of 129 cm at 294 K and 38.8 cm at that and higher temperatures resulted in a range of mass path lengths from 10 to 24 500 g/m^2. ***D. K. Edwards.*** *Optical Society of America, Journal,* v. 50, June 1960, p. 617-626.

10854* The Transparency of a Discharge in Xenon at Very High Pressures. The transparency of a Xe discharge in the visible was measured at very high pressures as a function of the discharge power per unit length. On the basis of the data obtained and the measured geometrical depth of the discharge, values were calculated for the absorption coeffiicent $\overline{\kappa}$. ***R. E. Rovinskii and G. P. Razumtseva.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 7, no. 6, Dec. 1959, p. 431-433.

10855* Apparatus Function of a Fabry-Perot Spectrometer With a Rectangular Aperture. It was found that the maxima are shifted in the same direction, but the magnitude of the shift is smaller than for the apparatus function of a spectrometer with a circular aperture. The curves have an asymmetry. ***R. I. Semenov, E. E. Fradkin, and M. P. Chaika.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 7, no. 6, Dec. 1959, p. 462-464.

10856* Determination of Absorption Spectra of Crystalline Phosphors by Means of Diffuse Reflection Spectra. The absorption and diffuse reflection spectra in the visible and near ultraviolet for a series of powdered materials (Se, CdI_2, PbI_2) and sulfide phosphors were studied and it was shown that the values of the absorption coefficients determined by diffuse reflection and directly by means of sublimated films, respectively, are in good agreement. ***I. P. Shapiro.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spectroskopiia*), v. 7, no. 6, Dec. 1959, p. 469-471.

10857 Optics of Thin Films. A survey and history of thin films in optics, which have been developed in the last two decades. The author has also contributed to the development of this branch of physics by several papers dealing with the measurement of a thin film on a dielectric (glass) and on metal by the polarimetric method, the theory of multiple thin films and achromatized thin films, the theory of reflection and refraction by a thin metallic film and questions of the connection between thin and thick films. ***A. Vašíček.*** 403 pp. 1960. Interscience Publishers, New York. (QC367 V44otr)

10858 The Infra-Red Absorption of Hot Semiconducting Diamonds. Measurements of the absorption of p-type semiconducting diamonds have been made at temperatures in the range 450 to 600 K and over the wavelength range between 6 and 45μ. The major effect observed is an absorption, which is present only in hot semiconducting diamonds, which increases with increasing wavelength and temperature. The increase with

temperature is similar to that of the increase in carrier concentration as determined from measurements of the Hall effect. ***C. D. Clark, P. Kemmey, E. W. J. Mitchell, and B. W. Henvis.*** *Philosophical Magazine*, v. 5, ser. 8, Feb. 1960, p. 127-139.

10859 Causality and Dispersion Relations for Fixed Momentum Transfer. In order to investigate which physical assumptions are relevant to the validity of dispersion relations for fixed momentum transfer, a simple case is treated: the scattering of a classical scalar field by an arbitrary spherically symmetric scatterer of finite radius. It is sufficient to assume: (a) restrictions, due to causality, on the propagation of signals with sharp fronts; (b) conditions on the behavior of the phase-shifts in the low-frequency and high-angular-momentum limits. ***H. M. Nussenzveig.*** *Physica*, v. 26, Apr. 1960, p. 209-229.

10860 Field Measurements in Resonant Cavities. The procentual shift of the resonant frequency of a cavity, perturbed by a small metallic body at a point of zero magnetic field, is proportional to the volume of the perturbing body, and to the square of the normalized unperturbed electric field. It is shown that the proportionality factor is only dependent upon the shape of the body and upon the orientation of the field. ***D. K. Callebaut and M. C. Vanwormhoudt.*** *Physica*, v. 26, Apr. 1960, p. 255-258.

10861 Temporal Fluctuations in a Classical Linear System. The time-dependent fluctuations in a system of N classical particles interacting with linear forces is investigated by the use of the theory of random time series given by Ming Chen Wang and Uhlenbeck. It is found that under certain assumptions the return to equilibrium may be interpreted as irreversible. ***R. E. Turner.*** *Physica*, v. 26, Apr. 1960, p. 274-283.

10862 Effects of Double Exchange in Magnetic Crystals. This paper discusses some effects of mobile electrons in some antiferromagnetic lattices. It is found that the canted arrangements are stable up to a well-defined temperature T_1. ***P. -G. De Gennes.*** *Physical Review*, v. 118, 2nd ser., no. 1, Apr. 1, 1960, p. 141-154.

10863 Quantum Statistics of Nonideal Systems. A new cluster development for the logarithm of the grand partition function of a system of interacting particles is derived. The leading term in this expansion is the pressure exerted by an ideal Bose or Fermi gas at the same temperature and absolute activity Z as the actual system. ***Frank H. Stillinger, Jr., and John G. Kirkwood.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 361-369.

10864 Transport Phenomena in Slightly Ionized Gases: High Electric Fields. Starting with the electron velocity distribution obtained by Chapman and Cowling for a Lorentzian gas, in the presence of an electric field, the author has investigated the variation with electric field of a number of transport properties, arising from a magnetic field, perpendicular to the electric field and temperature gradient in the gas. ***Mahendra Singh Sodha.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 378-381.

10865 Galvanomagnetic Effects in *n*-Type Silicon. The galvanomagnetic effects in n-type silicon have been investigated experimentally and theoretically at 77 K and 300 K. The samples ranged in resistivity from 0.2 to 27 ohm-cm. Measurements of the field dependence from 0.5 to 22 kilogauss of the Hall coefficient and the magnetoresistance for several orientations are presented. ***W. E. Krag.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 435-450.

10866 Temperature Dependence of Edge Emission in Cadmium Sulfide. The temperature dependence of the blue and the green emission in cadmium sulfide has been investigated in the temperature range from 77 K to 350 K. The blue emission shifts to longer wavelengths as the temperature is increased above 77 K. The intensity of the green emission falls off exponentially above 77 K with very little shift in the spectral position of the green peaks. ***D. C. Reynolds.*** *Physical Review*, v. 118, 2nd ser., no. 2, Apr. 15, 1960, p. 478-479.

10867 Significance of Potentials in Quantum Theory. The effects of the scalar and vector potentials in quantum mechanics, which were pointed out recently by Aharonov and Bohm, are discussed from the point of view of the consistency of the quantum-mechanical description of interference experiments. ***W. H. Furry and N. F. Ramsey.*** *Physical Review*, v. 118, 2nd ser., no. 3, May 1, 1960, p. 623-626.

10868 Nuclear Quadrupole Spin-Lattice Relaxation in Alkali Halides. Measurements were made on Na^{23} in NaCl, NaBr, and NaI; Cl^{35} in NaCl and KCl; $Br^{79,81}$ in NaBr, KBr, RbBr, and CsBr; Rb^{87} in RbCl and RbBr; and I^{127} in NaI, KI, and CsI. Over a temperature range of 298 K to 195 K the relaxation times are inversely proportional to the square of the absolute temperature. ***E. G. Wikner, W. E. Blumberg, and E. L. Hahn.*** *Physical Review*, v. 118, 2nd ser., no. 3, May 1, 1960, p. 631-639.

10869 Collision-Free Hydromagnetic Disturbances of Large Amplitude in a Plasma. Calculations are given of certain collision-free hydromagnetic disturbances produced by the rapid compression of a plasma containing a magnetic field. ***J. H. Adlam and J. E. Allen.*** *Physical Society, Proceedings*, v. 75, pt. 5, May 1960, p. 640-648.

10870 Heitler-London Approach to Electrical Conductivity and Application to *d*-Electron Conductions. Conduction by the movement of an extra electron which is tightly bound to an ion in an ionic lattice is discussed. The electrical conduction through d-electrons in the crystals such as $Li_xNi_{1-x}O$, $LaMnO_3$ + $SrMnO_3$, magnetite and $CoFe_2O_4$ is regarded as good examples to which the Heitler-London conduction mechanism is applicable. ***Jiro Yamashita and Tatumi Kurosawa.*** *Physical Society of Japan, Journal*, v. 15, May 1960, p. 802-821.

10871 Visible Light Emission and Microplasma Phenomena in Silicon *p-n* Junction. I. It has been found that the microplasma spot in the p-n junction can be located by scanning small chopped light spots on the junction surface. Combining this method of location of the microplasma spot and the observation by microscope, it is concluded that the light emitting spot does not necessarily coincide with the microplasma spot. ***Makoto Kikuchi and Kenkichi Tachikawa.*** *Physical Society of Japan, Journal*, v. 15, May 1960, p. 835-848.

10872 Formation of a Plasma by Low Energy Ion Injection and Cyclotron Heating. A new method has been devised to produce a high temperature plasma by injecting an ion beam into a static magnetic mirror field. In this method ions are injected along the axis of the d.c. magnetic field lines and are given energy through the oscillating electromagnetic field of the cyclotron frequency. ***Tarô Dodo.*** *Physical Society of Japan, Journal*, v. 15, May 1960, p. 906-916.

10873 Tiny Device Probes New Atomic Secrets. The Hughes detector which operates at room temperature can provide better analysis more accurately and much more cheaply. *Research/Development*, v. 11, June 1960, p. 85 + 2 pages.

10874 Ferrites. These iron oxide materials combine substantial magnetic strength with extremely high electrical resistance. Electrical engineers are using them in the design of revolutionary microwave devices. ***C. Lester Hogan.*** *Scientific American*, v. 202, no. 6, June 1960, p. 92-104.

10875 Ferrolectric Materials and Their Applications. Ferroelectric single crystals consist of spontaneously polarized domains, the electric dipole moment of which can be reversed by an external electric field. Ferroelectric single crystals are presently used in information storage devices, frequency control, dielectric amplifiers, delay lines and electromechanical filters. The present survey attempts to review the basic principles and application of ferroelectrics. ***Alfred Kremheller.*** *Sylvania Technologist*, v. 13, no. 2, Apr. 1960, p. 42-48.

10876 Numerical Computations for Self-Consistent Astron E Layer With Slowing Down of Electrons. *T. Seidman.* *U. S. Atomic Energy Commission, UCRL*-5789-T, Nov. 1959, 9 pp. (UF767 U3u Contin.)

10877 Surface Disturbances in Magnetohydrodynamics. There are four types of disturbances in magnetohydrodynamics. These depend on the character of step-changes of velocity and intensity of the field on the surface of the disturbance: tangential, perpendicular shock wave, inclined shock wave, and magnetohydrodynamic wave. All types of magnetohydrodynamic disturbances are related by mutual transitions. The steady state solutions to magnetohydrodynamic equations taken with the results of investigation of stability of tangential disturbances

permit the explanation of some characteristics of motion in the solar atmosphere, i.e., regular motion in solar protuberances. ***S. I. Syrovatskiy.*** *U. S. National Aeronautics and Space Administration, Technical Translation, NASA TT-F-23,* May 1960, 45 pp. (TL570 Un3tm Vis.)

10878* Radiation Field From a Rectangular Source. Many radiation shielding problems involve calculations of the response of an isotropic detector to radiation of arbitrary angular distribution from uniform rectangular sources. In calculations of this type the family of integrals $\int s(\cos\theta dS/r^2)P_1(\cos\theta)$ and the integral $\int s(dS/r^2)\exp(-\mu t/\cos\theta)$ are frequently encountered. ***J. H. Hubbell, R. L. Bach, and J. C. Lamkin.*** *U. S. National Bureau of Standards, Journal of Research, Section C, Engineering and Instrumentation,* v. 64C, no. 2, Apr.-June 1960, p. 121-138.

10879* The Luminescence of Manganese Activated Magnesium-Lithium Antimonates. The production and optical properties of a new, red, luminescent substance (maximum at 650 mμ) from the antimonate series ($6\ MgO \cdot 1{,}3Li_2O \cdot Sb_2O_5 \cdot 5 \cdot 10^{-3}Mn$) are described and a comparison with other similar bodies with emission in the red spectrum region is made. (*In German.*) Die Lumineszenz des Mangan-aktivierten Magnesium-Lithium-Antimonats. ***K. Th. Wilke.*** *Zeitschrift für Physikalische Chemie* (Leipzig), v. 213, nos. 5-6, 1960, p. 298-301.

10880* Quantum Mechanical Calculation of Pressure in Solid Bodies. A quantum mechanical formula for the pressure of a solid body at zero temperature is deduced which is a generalization of the virial theorem. Its application in the spherical cell approximation is considered in detail. (*In Russian.*) O kvantovomekhanicheskom raschete davleniia v tverdykh telakh. ***G. M. Ganbel'man and E. S. Pavlovskiĭ.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki,* v. 38, no. 4, Apr. 1960, p. 1176-1182.

10881* Build-Up of Electromagnetic Waves in a Plasma Moving in a Nondispersive Medium in the Presence of a Constant Magnetic Field. A dispersion equation has been obtained which describes the propagation of plane electromagnetic waves in a plasma beam moving in a fixed plasma along the lines of force of a constant and homogeneous magnetic field. The damping (or build-up) coeffiicents of the waves as a function of time have been found for a rarefied plasma moving along the magnetic field through a nondispersive dielectric. (*In Russian.*) O narastanii elektromagnitnykh voln v plazme, dvizhushcheĭsia v dielektrike bez dispersii, pri nalichii postoiannogo magnitnogo polia. ***G. G. Getmantsev and V. O. Rapoport.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki,* v. 38, no. 4, Apr. 1960, p. 1205-1211.

PLASTICS

10882* Plastics—The Toxicology of Synthetic Resins. A compilation of the literature concerning the toxicological properties of synthetic resins. ***Rex H. Wilson and William E. McCormick.*** *A.M.A. Archives of Industrial Health,* v. 21, no. 6, June 1960, p. 536-548.

10883* Plastic Pipe—How Good Is It? The information received from visits made to gas companies, plastic pipe fabricators, and raw materials suppliers, and from surveys of trade literature and published papers is presented to answer the following questions requested by the Gas Operations Research Committee of the American Gas Association: why is or is not plastic pipe being used; what are its advantages over other pipe; what problems have been encountered; and where or how can plastic pipe be improved to meet more fully the requirements of all the gas distribution companies? ***H. W. Kuhlmann.*** *American Gas Association Monthly,* v. 42, no. 6, June 1960, p. 15 + 3 pages.

10884* Vinyl Polymerization. XLIII. Polymerization of Styrene With Vinyl-Magnesium Chloride. ***Minoru Imoto and Masayoshi Kinoshita.*** *Chemical Society of Japan, Bulletin,* v. 33, no. 4, Apr. 1960, p. 490-493.

10885* Polymerization of Methyl Methacrylate Initiated by a Combined Action of *p*-Tolylsulfonylacetic Acid and Dimethylaniline. ***Ryoichi Uehara.*** *Chemical Society of Japan, Bulletin,* v. 33, no. 5, May 1960, p. 698-700.

10886 Mystery Polymers. Artrite Resins, Ltd., Camberley, Surrey, England, claims development of tough, heat-stable polymers (to 600 C) and resinous products (to 1000 C) based upon P and B. A typical compound rated 23,500 psi at 700 C for punch shear test. *Chemical Week,* v. 86, no. 23, June 4, 1960, p. 53-54.

10887* Polymerizations Promoted by Metal Amide Compounds and Their Stereospecificities. Stereospecific and nonstereospecific polymerizations, of some olefinic and acrylic monomers, carried out with catalysts prepared using metal amide compounds, instead of metallorganic compounds, is described. Metal amide compounds of lithium and magnesium promote by themselves, in the absence of transition metal compounds, the stereospecific polymerization of some alkyl acrylates and methacrylates. (*In Italian.*) Polimerizzazioni promosse da composti metallo ammidici e loro stereospecificità. ***G. Natta, G. Mazzanti, P. Longi, and F. Bernardini.*** *Chimica e l'Industria,* v. 42, May 1960, p. 457-462.

10888* Heat of Copolymerization in Unsaturated Polyester Resins. Heat of polymerization of unsaturated polyester resins, expressed as excess above the heat of polymerization of styrene contained in the resin, is an increasing function of maleic anhydride/styrene ratio, independently of the absolute amounts of the two compounds, when the proper quantity of initiator is added. From measures of heat of copolymerization, the quantity of maleic anhydride can also be determined, when the styrene content is known. (*In Italian.*) Calore di copolimerizzazione in resine poliestere non sature. ***Walter Sbrolli.*** *Chimica e l'Industria,* v. 42, May 1960, p. 475-479.

10889 Nuclear Magnetic Resonance Studies of Polyethylene Terephthalate and Related Polyesters. Nuclear magnetic resonance measurements have been made on polyethylene terephthalate and related polyesters in which the glycol residue contains between four and ten methylene groups, over the temperature range from −180 C to 200 C. ***I. M. Ward.*** *Faraday Society, Transactions,* v. 56, May 1960, p. 648-659.

10890 Elasticity of Polymer Networks Cross-Linked in States of Strain. Simultaneous formation and destruction of cross linkages in a state of strain is treated theoretically. Non-exponential decay of stress is predicted for concurrent rupture and (independent) re-formation of cross linkages, the total number remaining constant. ***P. J. Flory.*** *Faraday Society, Transactions,* v. 56, May 1960, p. 722-743.

10891 Physical Properties of Vinyl Polymers. I. Dependence of the Glass-Transition Temperature of Polymethylmethacrylate on Molecular Weight. The glass-transition temperature has been determined by a refractometric technique for a series of low-conversion polymethylmethacrylate specimens prepared by free-radical polymerization. The polymers varied in number-average molecular weight from 3000 to 76,000 and showed a similar dependence of the glass-transition temperature on molecular weight to that observed for polystyrene and polyisobutylene. ***R. B. Beevers and E. F. T. White.*** *Faraday Society, Transactions,* v. 56, May 1960, p. 744-752.

10892* Studies on the Microscopical Structure of Polyamide-6-Fibres. The microscopical photos of polyamide-6-fibers, degraded enzymatically in the living organism, are shown and discussed. Likewise, the phenomena are described which result during the destruction of artificially produced fiber membranes. In both cases, a lamellar structure is to be perceived which may lead to the conclusion of a skin type structure. Connections between this structure and the properties of the polyamide-6-fibers are considered. (*In German.*) Studien über die mikroskopische Struktur von Polyamid-6-Fasern. ***Karl Schwertassek.*** *Faserforschung und Textiltechnik,* v. 11, Mar. 1960, p. 125-129.

10893* Polymerization of Propylene on Alumosilicate Catalysts of Different Composition. Propylene polymerization at atmospheric pressure, at 200 C and with a gas supply speed of 2.0 to 8.0 1/hr in the presence of these catalysts was investigated. The maximum depth of transformation of the gas and the highest yields of polymerizate fractions are observed during the polymerization of propylene over catalysts with 10 to 12% Al oxide. Increasing the Al_2O_3 content in the catalyst by 20% leads to a decrease of the depth of transformation of

propylene and of the yields of polymerizate fractions. (*In Russian.*) Polimerizatsiia propilena nad aliumosilikatnymi katalizatorami razlichnogo sostava. ***Ch. S. Karryev and G. M. Panchenkov.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, Neft' i Gaz,* v. 3, no. 5, 1960, p. 87-91.

10894* Short-Time Stress Relaxation and Toughness of Rubber-Modified Polystyrene. Measurements were made at room temperature on injection-molded bars of polystyrene, styrene-acrylonitrile copolymer, and a rubber-styrene polymer. No correlation could be seen between the short-time stress-relaxation rates and impact resistance or "toughness." A mechanism of reinforcement of polystyrene by rubber particles is proposed. ***J. A. Schmitt and Henno Keskkula.*** *Journal of Applied Polymer Science,* v. 3, no. 8, Mar.-Apr. 1960, p. 132-142.

10895* Stress Relaxation for Biaxial Deformation of Filled High Polymers. A constitutive equation is derived for stress-relaxation in isotropic incompressible viscoelastic solids at small constant deformations. This is used to calculate the torque and tensile force necessary to maintain simultaneous torsion and simple extension in a straight circular tube. ***J. T. Bergen, D. C. Messersmith, and R. S. Rivlin.*** *Journal of Applied Polymer Science,* v. 3, no. 8, Mar.-Apr. 1960, p. 153-167.

10896* Thermally Stable Polymers From Condensation Polymerization of Perfluoroalkylamidines. Perfluoroalkyldiamidines and cyclic perfluoroalkylimidines undergo condensation polymerization with the liberation of ammonia to produce infusible polymers that are stable to heating in air at 350° and are not attacked by strong oxidizing agents. Copolymerization of perfluoroalkyldiamidines or perfluoroalkylimidines with perfluoroalkylmonoamidines produces polymers that are equally stable at high temperatures and that range in physical characteristics from viscous liquids to elastomeric gums. A probable structural unit for this new polymer system consists of *s*-triazine rings linked by perfluoroalkyl chains. ***Henry C. Brown.*** *Journal of Polymer Science,* v. 44, May 1960, p. 9-22.

10897* Proton Magnetic Resonance in Irradiated and Unirradiated Polyvinyl Alcohol. Crystalline and amorphous components in PVA were investigated by the analysis of the line shapes of the NMR spectra of several samples being different in the degree of polymerization and in the forms. Measurements of the temperature dependence of the line shape, the line width, and the second moments were also performed for the irradiated and unirradiated samples. ***Shizuo Fujiwara.*** *Journal of Polymer Science,* v. 44, May 1960, p. 93-105.

10898* Solid State Polymerization of Acrylamide Initiated by Gamma Radiation. The solid-state polymerization of acrylamide, both in a radiation field and after removal from the field, is shown to proceed by an unusual kinetic mechanism. The usual steady state assumption is found to be inadequate because there seems to be no free radical termination involved. These results are consistent with the view that the solid-state polymerization proceeds by a nucleation mechanism in which the free radicals are probably trapped by overlapping of the reactive sites. ***B. Baysal, G. Adler, D. Ballantine, and P. Colombo.*** *Journal of Polymer Science,* v. 44, May 1960, p. 117-127.

10899* Polyesters From Epoxides and Anhydrides. The reaction of monoanhydrides and terminal epoxides to give linear polyesters is 98-99% specific in the presence of tertiary amines. Products with molecular weights up to 18,400 have been obtained; the only termination reaction detected has been due to hydroxyl-containing impurities in the reagents. ***R. F. Fischer.*** *Journal of Polymer Science,* v. 44, May 1960, p. 155-172.

10900* Oxidation and Grafting of Benzyl and Ethyl Cellulose. The preparation of graft copolymers of benzyl and ethyl cellulose was attempted through the initiation of vinyl polymerization by the cellulose ether hydroperoxides. The benzyl and ethyl cellulose ether hydroperoxides were prepared in solution by oxidizing with air. The polymer underwent severe chain degradation concurrently with hydroperoxide formation. ***E. Gleason and V. Stannett.*** *Journal of Polymer Science,* v. 44, May 1960, p. 183-194.

10901* Graft Copolymerization by a Preirradiation Method. Free radicals as well as peroxides are formed when irradiation of polyethylene is accomplished with the use of cobalt-60 or a Van de Graaff electron accelerator, as radiation sources, even in the presence of air. The free radicals are able to induce graft copolymerization under low temperatures, in which peroxide grafting cannot occur. In graft copolymerization by free radicals, the percent grafting is proportional to the square root of the free radical content, and the higher grafting temperature, the faster the initial rate of graft copolymerization. There occurs, however, a saturation phenomenon of the percent grafting with a grafting time, especially in high temperatures, and the higher the grafting temperature, the smaller the saturation value. It is believed that the kinetic theory of vinyl polymerization in a homogeneous system is applicable for graft reaction in spite of its apparent heterogeneous character. ***Y. Shinohara and K. Tomioka.*** *Journal of Polymer Science,* v. 44, May 1960, p. 195-211.

10902* Infrared Spectra and Crystal Structures of Polyamides. Infrared spectra and X-ray diffractions of 24 nylons were investigated. ***Akihisa Miyake.*** *Journal of Polymer Science,* v. 44, May 1960, p. 223-232.

10903* Block Copolymers From a Dihydroperoxide. I. The Hydroperoxide-Ended Polystyrenes. Method for the production of simple block copolymers of styrene and methyl methacrylate is outlined; in the method a dihydroperoxide is used as a thermal initiator for the polymerization of styrene, giving a polystyrene with hydroperoxide end-groups; the polymer is then reacted in emulsion with ferrous ions and methyl methacrylate to produce the block copolymer. ***P. Molyneux.*** *Makromolekulare Chemie,* v. 37, no. 3, May 1960, p. 165-186.

10904* Elastomer Behavior. I. Rupture Elongation. Theoretical treatment of the extension at rupture of an elastomer. Treatment shows that the extensibility is greater for elastomers with low crosslink density, chain-length homogeneity, and low cross-link functionality, and less for elastomers with high cross-link density, chain-length heterogeneity, and high functionality of cross links. ***L. C. Case.*** *Makromolekulare Chemie,* v. 37, no. 3, May 1960, p. 243-250.

10905 High Temperature Plastics: Where Do We Stand? A timely assessment of our progress in developing organic, semi-organic, and inorganic polymers for long-time service at 500 F and above. The first of five papers on the high-temperature problems involving power generators, textiles, use of Re metal, and high-temperature metals. ***W. Brenner.*** *Materials in Design Engineering,* v. 51, June 1960, p. 132-134.

10906 High-Clarity Blown Polyethylene Film. A method for improving the optical properties of blown polyethylene film by using a tubular annealing chamber has been studied. Theory of the technique is discussed and details of construction and positioning of the annealing chamber are given. Data are given showing how the annealing chamber affects resins of various melt indices and densities at various retention times. Limitations of the technique are also discussed. ***Joseph Pilaro and Richard Kremer.*** *Modern Plastics,* v. 37, no. 10, June 1960, p. 115 + 4 pages.

10907 Design Tips for Polyolefin Parts. How to overcome molding defects in polyolefin parts through proper design. ***J. N. Scott, J. V. Smith, and D. L. Alexander.*** *Modern Plastics,* v. 37, no. 10, June 1960, p. 130 + 3 pages.

10908 Permeability of Chlorotrifluoroethylene Polymers. The permeability of a number of modifications of chlorotrifluoroethylene polymers to gases (N_2, O_2, and CO_2) and vapors (water and methanol) was investigated. The effects of crystallinity, plasticization, and copolymerization with vinylidene fluoride are considered. ***A. W. Myers, V. Tammela, V. Stannett, and M. Szwarc.*** *Modern Plastics,* v. 37, no. 10, June 1960, p. 139 + 4 pages.

10909 Molybdenum Disulfide in Nylon for Wear Resistance. Injection molded parts have better wear and abrasion resistance, lower coefficients of friction, and better dimensional stability than parts made of conventional nylon. Molders report faster molding cycles, less shrinkage and distortion, easier ejection, and reduced mold lubrication, all of which tend to cut molding costs. ***Thomas E. Powers.*** *Modern Plastics,* v. 37, no. 10, June 1960, p. 148 + 3 pages.

10910 Influence of the Molecular Weight Distribution on the Polymer Properties. The Schulz-Zimm expression of the molecular weight distribution in a polymer sample is con-

veniently extended in terms of associated Laguerre polynomials. ***Akira Miyake and Hatsuko Adachi.*** *Physical Society of Japan, Journal*, v. 15, May 1960, p. 883-887.

10911* Post-Molding Operations on Acetal Resin. Comprehensive discussion of methods for machining and joining molded Delrin. ***R. I. Miller.*** *Plastics Technology*, v. 6, June 1960, p. 29-35.

10912* 'Pro-Fax' Polypropylene. Properties of 'Pro-fax' are given in tabular form. Molding, extrusion, and applications in packaging and monofilaments are discussed. *Rubber and Plastics Age*, v. 41, May 1960, p. 484 + 3 pages.

10913* Fabrication and Applications of 'Fluoroflex' PTFE Pipes and Fittings. A 'Teflon'-lined piping system not only resists temperatures up to 260 C but is unaffected by nearly all chemicals and is almost universally useful for corrosion-proof service. *Rubber and Plastics Age*, v. 41, May 1960, p. 499 + 1 page.

10914* 'Thermalon' Urea Formaldehyde Foam for Thermal Insulation. 'Thermalon' urea-formaldehyde foam provides an eminently practical and simple method of insulating both cavity walls and roof spaces for new or used buildings. The low k value, 0.21 B.Th.U./sq.ft./hr./°F., reduces conduction heat losses by up to 50%. It will not support combustion, and tolerates temperatures up to 120 C and down to subzero temperatures. *Rubber and Plastics Age*, v. 41, May 1960, p. 504.

10915* Plastics in Cables. IV. Processing of Thermoplastics. The change from the short screw to the long screw, and from low speeds to high speeds has resulted in certain fundamental changes in processing techniques. ***W. S. Penn.*** *Rubber Journal and International Plastics*, v. 138, no. 21, May 21, 1960, p. 761 + 4 pages.

10916* Compounding Cross-Linked Polyethylene. Polyethylene can be made a thermosetting material with many engineering possibilities while retaining most properties of thermoplastic state. ***B. C. Carlson.*** *Rubber World*, v. 142, no. 3, June 1960, p. 91-96.

10917* The Chemistry of Vulcanization of "Viton" a Fluorocarbon Elastomer. Commonly used curing systems and outlines the evidence on which a mechanism for their action may be based. ***J. F. Smith.*** *Rubber World*, v. 142, no. 3, June 1960, p. 102-107.

10918 Transparent Cold-Shock-Resistant Epoxy Costing Resin. Discusses the development of a transparent cold-shock-resistant epoxy casting resin; physical and electrical properties are presented. In addition, a simple inexpensive test method for determining cold-shock-resistance is described. ***Ben Carroll and John Smatana.*** *U. S. Atomic Energy Commission, SCR-173*, Apr. 1960, 34 pp. (UF767 Un3.1scr Contin.)

See also: **9933** (polypropylene via Ziegler process).

POLLUTION AND WASTES

10919* Air Pollution. An Annotated Bibliography. This bibliography lists references representing the American Petroleum Institute's contributions toward solution of community air pollution problems. 12 pp. March 1960. American Petroleum Institute, New York. (ZTD884 Am35a Ref.)

10920* Air Pollution Problems of the Steel Industry. Informative Report. ***Wesley C. L. Hemon, editor.*** *Air Pollution Control Association, Journal*, v. 10, no. 3, June 1960, p. 208 + 11 pages.

10921 A Digest of State Air Pollution Laws. ***Samuel M. Rogers and Sidney Edelman.*** 117 pp. 1959. U. S. Department of Health, Education, and Welfare, Washington, D. C. (TD884 Un3.61d)

10922 The Effect of Preaeration on the Primary Treatment of Sewage. The development and present status of the preaeration process, preparatory work at the Ames plant, full-scale plant runs, laboratory-scale tests, final laboratory and test procedures, and other problems are discussed. ***Harris F. Seidel and E. Robert Baumann.*** *Iowa State University, Iowa Engineering Experiment Station, Bulletin No.* 187, Feb. 24, 1960, 48 pp. (T21 I9b Vis.)

10923* Regenerative Purification of Sewer Waters Containing *n*-Nitrophenol. The method described is based on the adsorption of *n*-nitrophenol on activated carbon and on subsequent carbon regeneration by alkali. The dynamic capacity of carbon in relation to *n*-nitrophenol is 24%. Applied to sewer waters derived from the manufacture of *n*-nitrophenol, *n*-nitrophenetol and *n*-nitroanisol, this method permits full extraction of *n*-nitrophenol from sewers. (*In Russian.*) Regenerativnaia ochistka stochnykh vod, soderzhashchikh *n*-nitrofenol. ***R. M. Bekher and N. P. Myshkina.*** *Ukrainskĭ Khimicheskĭ Zhurnal*, v. 26, no. 2, 1960, p. 270-272.

10924* A Review of the Literature of 1959 on Wastewater and Water Pollution Control. ***H. Heukelekian, et al.*** *Water Pollution Control Federation, Journal*, v. 32, June 1960, p. 545-593.

See also: **9927** (horizontal flooded bed gas scrubber); **9954** (effluent treatment at a fine chemicals factory); **9955** (effluent treatment in pesticide manufacture).

RUBBER AND ELASTOMERS

10925* Tung Oil Derivatives as Plasticizers for Buna-N Rubber. The preparation and properties of the methyl vinyl ketone, dimethyl maleate, methyl acrylate, and acrylonitrile adducts of tung oil as well as their hydrogenated counterparts and their plasticizing characteristics for Buna-N rubber are discussed. Hydrogenation of the tung oil adducts resulted in a slight impairment of their plasticizing efficiency. ***Lida L. Placek, H. P. Pastor, J. P. Hughes, and W. G. Bickford.*** *American Oil Chemists' Society, Journal*, v. 37, June 1960, p. 307-309.

10926* Elastomers From Chlorosulphonated α-Olefin Polymers and Copolymers. Results obtained in the chlorosulphonation and subsequent curing tests of atactic poly-α-olefins and of the ethylene-α-olefin copolymers are reported. The curing of these polymers through chlorosulphonation has been used for a preliminary evaluation of their elastomeric properties in function of their chemical constitution and structure. This was possible owing to the small amount of chlorine and chlorosulphonic groups necessary for a good curing, to the high molecular weight and to the lack of crystallinity of the examined polymers. (*In Italian.*) Elastomeri da polimeri e copolimeri clorosolfonati delle alfa-olefine. ***G. Natta, G. Crespi, and M. Bruzzone.*** *Chimica e l'Industria*, v. 42, May 1960, p. 463-467.

10927* Some Aspects of High Temperature Vulcanisation. When a thin rubber sample is heated to a high curing temperature, the initial kinetics of cure as derived from Newton's rule can be represented by a well-defined time delay at the final curing temperature. This facilitates quantitative studies for which it is also shown that first order changes in cross-link density can be assessed by modulus measurements. ***G. Bielstein.*** *Institution of the Rubber Industry, Transactions*, v. 36, no. 2, Apr. 1960, p. 29-44.

10928* Mechanico-Chemical Reactions Leading to Reinforcement in Rubbers. I. Interaction With Aluminium Alkoxides. Mechanico-chemical reactions in rubbers and plastomers leading to interaction with fillers, monomers and other polymers are summarized. Experimental data is presented for the mechanico-chemical interaction of multifunctional polar reagents, in particular aluminum isopropoxide, with natural rubber to form gel under conditions producing mechanical shear. An indication of the applications of the process to synthetic rubbers and to the reinforcement of natural rubber gum stocks is given. ***R. J. Ceresa.*** *Institution of the Rubber Industry, Transactions*, v. 36, no. 2, Apr. 1960, p. 45-57.

10929* Interaction of Hydrocarbons and Powders. The reinforcement of rubber and the differences between various powders in their reinforcing effect are discussed. Hydrocarbons of low molecular weight have been used as models for rubber

and the energy of adsorption on to a range of powders considered. ***W. C. Wake.*** *Institution of the Rubber Industry, Transactions*, v. 36, no. 2, Apr. 1960, p. 58-64.

10930* Mechanical apd Thermal Properties of the Polymers in the Solid State. I. Critical Account of Previous Data. II. Theoretical and Experimental Study of a Method of Measurement of the Viscoelastic Moduli With Ultrasonic Frequencies. III. Viscoelastic Characteristics of Some Polymers With Ultrasonic Frequencies. (*In French.*) Propriétes mecaniques et thermiques des polymères a l'etat solide. I. Exposé critique des données antérieures. II. Etude théorique et expérimentale d'une méthode de mesure des modules viscoélastiques aux fréquences ultrasonores. III. Caractéristiques viscoélastiques de quelques polymères aux fréquencies ultrasonores. ***René Buvet.*** *Journal de Chimie Physique*, v. 57, Apr. 1960, p. 255-286.

10931* Rupture of Rubber. VI. Further Experiments on the Tear Criterion. VII. Effect of Rate of Extension in Tensile Tests. VIII. Comparisons of Tear and Tensile Rupture Measurements. VI. ***A. G. Thomas.*** VII.-VIII. ***H. W. Greensmith.*** *Journal of Applied Polymer Science*, v. 3, no. 8, Mar.-Apr. 1960, p. 168-193.

10932* The Interaction Between Styrene-Butadiene Rubber and Carbon Black on Heating. The interaction between a carbon black filler and styrene-butadiene rubber is increased if the material is heated after milling. This effect has been attributed to the polymeric free radicals which are presented after milling but which require a high temperature to increase their mobility to the point where they can react. The extent of interaction increases with time of heating and with the amount of milling before heating. The postulated mechanism is supported by the experimental activation energies and by the predictable influence of free radical scavengers on the system. ***J. P. Berry and P. J. Cayré.*** *Journal of Applied Polymer Science*, v. 3, no. 8, Mar.-Apr. 1960, p. 213-223.

10933* The Reinforcement of Natural Latex and Synthetic Latex Films With Silica Sols. The investigations were carried out with silica sols being translucent, genuine colloidal solutions of finest dispersed silica. The test results with 15 and 30% silica sols in films of natural latex show a definite reinforcing effect. Tensile strength, modulus of elongation and cut growth resistance are considerably increased, the swelling behavior is improved. Hot air aging tests showed an increase in the aging resistance, whereas with oxygen bomb tests, the values of the vulcanizates containing SiO_2 were only slightly above those without SiO_2. (*In German.*) Über die Verstärkung von Naturlatex- und Syntheselatex-Filmen mit Kieselsolen. ***H. Esser and G. Sinn.*** *Kautschuk und Gummi*, v. 13, May 1960, p. 126WT-132WT.

10934* Studies on the Mechanism of Film Formation From Vulcanized Latex. II. The Formation of Films From the Butadiene-Styrene Latex SKS-30. The strength of the unvulcanized synthetic latex films is determined primarily by Vander-Waals forces, whereas the strength of films from vulcanized latex is determined by the presence of a continuous molecular network typical for vulcanizates. The addition of casein to the butadiene-styrene latex brings a number of properties of the films nearer to those from natural latex. (*In Russian.*) Issledovanie mekhanizma obrazovaniia plenok iz vulkanizovannogo lateksa. II. Plenkoobrazovanie iz butadienstirol'nogo lateksa SKS-30 ShKhP. ***S. S. Voyutskiĭ, D. M. Sandomirskiĭ, N. M. Fodiman, R. M. Panich, and Z. M. Ustinova.*** *Kolloidnyĭ Zhurnal*, v. 22, no. 2, Mar.-Apr. 1960, p. 143-147.

10935* Electron Microscopic Study of the Structures of Reinforced Rubbers. An electron microscopic study of reinforced rubber solutions revealed the presence of sol and gel rubber fractions and of loose coagulation structures of the fillers. The high dispersity, low aggregation tendencies, and the ability to form loose network and chain coagulation structures on the part of aluminate and silicate fillers are highly important factors in the reinforcement of rubbers. (*In Russian.*) Elektronno-mikroskopicheskoe issledovanie struktur usilennykh kauchukov. ***V. A. Shvetsov, A. P. Pisarenko, B. V. Shtarkh, and A. S. Novikov.*** *Kolloidnyĭ Zhurnal*, v. 22, no. 2, Mar.-Apr. 1960, p. 233-236.

10936* Dynamic Behavior of Rigid PVC. By means of rotary flexing tests carried out on rigid PVC rods over a temperature range of −30 to 50 C, its creep strength was determined by Wöhler curves. Utilizing the temperature increase within the rods caused by repeated flexing, the internal damping of the material was determined. Examination of the fractured surfaces enables certain conclusions to be drawn regarding the fracture mechanism. (*In German.*) Dynamisches Verhalten von Hart-PVC. ***Siegmund Wintergerst.*** *Kunststoffe*, v. 50, May 1960, p. 277-280.

10937* The Thermodegradation Mechanism of PVC. Because of the close connection that exists between processing conditions and thermal degradation of PVC, much research has been carried out on the subject. Deals with the nature of side effects and the influence of free hydrochloric acid developed as a result of degradation on color changes. It is considered that the presence of O_2 contributes to some considerable extent to these changes. (*In German.*) Zum Mechanismus der Thermodegradation von PVC. ***J. Novák.*** *Kunststoffe*, v. 50, May 1960, p. 291-293.

10938* Laboratory Processing Properties of Two Synthetic Polymers. Times required for incorporation and equivalent states of dispersion of reinforcing furnace blacks in styrene and acrylonitrile-butadiene rubbers can be accurately measured from laboratory Banbury power consumption curves. These curves are typical and reproducible for the various types of styrene and acrylonitrile-butadiene rubbers, and they are sensitive enough to distinguish minor differences in black pigment incorporation times between various lots of a specific type of rubber. ***K. C. Beach, L. F. Comper, and V. E. Lowery.*** *Rubber Age*, v. 85, no. 2, May 1959, p. 253-258.

10939* 'Lamiflo' Rubber Skin for Boundary Layer Stabilisation. A specially designed rubber coating that will permit vessels to travel with greater efficiency. *Rubber and Plastics Age*, v. 41, Apr. 1960, p. 387-388.

10940* Stress-Strain Isotherm for Polymer Networks. The present experimental investigation was undertaken for the purpose of ascertaining the dependence of C_2 on the constitution and chemical nature of the polymer system, and on the experimental conditions adopted for determining the stress-strain relationship. Five different polymer types have been investigated. The influence of temperature, dilution, degree and method of crosslinking, and period of relaxation at each elongation have been explored. The results afford compelling evidence for the conclusion that the C_2 term is baseless. ***A. Ciferri and P. J. Flory.*** *Rubber Chemistry and Technology*, v. 33, no. 2, Apr.-June 1960, p. 254-271. (Reprinted from the *Journal of Applied Physics*, v. 30, no. 10, Oct. 1959, p. 1498-1507.)

10941* Reinforcement of Rubber by Fillers. Tear Resistance. The results of experimental studies on (1) the effect of reinforcing fillers on tear strength and on the roughness of the resultant torn surfaces, (2) the relative adhesion of rubber to fillers and (3) the effect of hysteresis on tear strength are critically examined. They show that the maximum reinforcing effect of fillers is only exhibited if sufficient time is allowed for their strengthening role to develop during tearing, and that under these conditions the tip of the growing tear is broader and the torn surface rougher. ***L. Mullins.*** *Rubber Chemistry and Technology*, v. 33, no. 2, Apr.-June 1960, p. 315-325. (Reprinted from the *Proceedings of the International Rubber Conference*, Washington, D. C., Nov. 1959, p. 389-395.)

10942* Adhesion of High Polymers. VI. The Effect of the Molecular Weight of Butadieneacrylonitrile Copolymers of Various Polarities on Their Adhesion to Polar and Non-Polar Substrates. The adhesion of each of the copolymers investigated has been shown to fall with increase in molecular weight up to a certain limit (300,000–350,000), above which its value remains practically constant. Increase in the contact temperature raises the adhesion of all fractions. (*In Russian.*) Adgeziia polimerov. VI. Vliianie molekuliarnogo vesa butadienakrilonitril'nykh sopolimerov razlichnoĭ poliarnosti na ikh adgeziiu k poliarnomu i nepoliarnomu substratam. ***V. L. Vakula, Khe Iun'-tszuĭ, V. E. Gul', and S. S. Voiutskiĭ.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 5, May 1960, p. 636-645.

SPACE HEATING AND CONDITIONING

10943* Comparative Cost of High Velocity Dual Duct Systems. There are many factors that influence the owning and

installed costs of air conditioning systems. A discussion of the economic aspects of practices as related to high velocity dual duct systems. ***N. S. Shataloff.*** *Air Conditioning, Heating and Ventilating*, v. 57, June 1960, p. 55-61.

10944* Centrifugal Fan Application Guide. III. Will the Fan Be Noisy? Develops a simple and practical approach to the problem of fan noise. Four rules for specifying the quietest possible conditions are given. Five rules cover the question of acoustical treatment. ***C. J. Trickler.*** *Air Conditioning, Heating and Ventilating*, v. 57, June 1960, p. 71-74.

10945* Noise and Vibration in Air Handling Systems. These two engineering bugaboos cause serious problems in locations where decibel level is critical. Here are 14 procedures to eliminate these problems. ***Carl O. Wood.*** *Air Engineering*, v. 2, no. 6, June 1960, p. 23 + 4 pages.

10946 Design of Industrial Exhaust Systems. Flow of fluids, hoods for dust control, for fume, smoke and vapor control, air flow through hoods, pipe resistance, piping design, dust separators, low pressure conveyors, centrifugal exhaust fans, axial flow fans, structural details and field measurements are discussed. ***John L. Alden.*** 3rd Ed. 243 pp. 1959. The Industrial Press, New York. (TJ960 AL22d3)

10947* Warm-Air Heating With Electric Furnaces. Systems involving the use of electric warm-air furnaces can be designed and installed by the same general methods followed where gas or oil is the fuel. Only a few departures from standard application procedures are necessary. ***Don Winegardner.*** *Heating & Air Conditioning Contractor*, v. 51, no. 9, June 1960, p. 49-53.

10948 In Alaska, Return Air Heater Systems Buck Quick, Extreme Weather Changes. Alaska's frequent daily outdoor temperature variations of 100 F being too rugged for conventional heating methods, a return air heating system has been devised to provide indoor comfort in spite of extremely fast temperature drops and increases. ***John D. Aungst.*** *Heating, Piping & Air Conditioning*, v. 32, June 1960, p. 128-131.

10949 Supply Makeup Air for Plant Exhaust Without Adding to Heating Costs. In many manufacturing plants, particularly foundry operations, huge amounts of air must be exhausted to carry off the fumes, dust, gases. The makeup air that must be admitted to balance the exhaust can add considerably to heating costs. Discusses how these heating costs can be avoided. ***H. P. Kaulfuss.*** *Heating, Piping & Air Conditioning*, v. 32, June 1960, p. 132-135.

10950* The Heating and Air-Conditioning of Lloyd's New Building, London. The heating and air-conditioning are described in detail. ***J. R. Kell and L. N. Doe.*** *Institution of Heating and Ventilating Engineers*, v. 28, May 1960, p. 37-56.

10951* Heat Requirements and "Heating Effect". It is concluded that a widely distributed heat input at a low level round the exposed perimeter of a room is likely to show a reduction in heat requirement of at least 10%. In larger buildings, the combined use of downward radiation, with minimum convection, and perimeter heating will show a similar saving. ***P. A. Coles.*** *Institution of Heating and Ventilating Engineers*, v. 28, June 1960, p. 82-107.

10952* The Sound Absorption Properties of Urethane Foams. The use of urethane foams as sound absorbers offers many advantages, due to the ease of application and many other such valuable properties of urethanes. This article shows that urethane foams, either preformed and cut, or sprayed, can exhibit good to excellent sound absorption properties. ***George L. Ball, III, M. Schwartz, and J. S. Long.*** *Official Digest*, v. 32, June 1960, p. 817-831.

See also: **9919** (ventilation in chemical industry).

TEXTILES, FIBERS, LEATHER, AND PAPER

10953* The Practical Identification of Some Condensed Tannins in Leather by Chromatographic and Photometric Methods. The methods are based on the use of conventional paper chromatography coupled with selective spray reagents and on the generation of anthocyanidins from condensed tannins. ***D. G. Roux.*** *American Leather Chemists Association, Journal*, v. 55, May 1960, p. 272-284.

10954* The Formation of Fibrils From Collagen Solutions. I. The Effect of Experimental Conditions: Kinetic and Electron-Microscope Studies. When the rate of precipitation was increased by increasing the temperature or lowering the ionic strength, fibril width decreased, but when the rate was increased by reducing the pH, fibril width increased. The variation of rate of precipitation with ionic strength and pH indicates that it is controlled to a significant degree by electrostatic interaction between the soluble collagen particles. All precipitation curves showed a lag period, followed by a sigmoid growth curve. Both phases were accelerated by increase of temperature but the width of the ultimate fibrils was affected only if the temperature was increased during the lag period. It is concluded that most of the fibrils were formed during the lag period. ***G. C. Wood and M. K. Keech.*** *Biochemical Journal*, v. 75, no. 3, June 1960, p. 588-598 + 2 plates.

10955* The Formation of Fibrils From Collagen Solutions. II. A Mechanism of Collagen-Fibril Formation. Fibril formation is regarded as the result of two processes: (a) nucleation, i.e., the aggregation of soluble collagen particles to form nuclei, the smallest aggregates capable of existing as a separate phase; (b) growth of the nuclei into fibrils by accretion of further soluble collagen particles. It is assumed that reaction of the soluble collagen particles with the surface of the growing fibrils controls the rate of growth and that the former process is proportional to the surface area of the precipitate and to the collagen concentration. The activation energy for growth is calculated to be 27 kcal./mole (at pH 7.1, *I* 0.23, collagen concentration 0.05%. ***G. C. Wood.*** *Biochemical Journal*, v. 75, no. 3, June 1960, p. 598-605.

10956* The Formation of Fibrils From Collagen Solutions. III. Effect of Chondroitin Sulphate and Some Other Naturally Occurring Polyanions on the Rate of Formation. Low concentrations of heparin and deoxyribonucleic acid have been found to retard fibril formation in solutions of acid-soluble collagen at pH 7, *I* 0.23 and 25°. Two types of choncroitin sulfate (A and C) and a preparation rich in keratosulfate accelerated fibril formation. Another type of chondroitin sulfate (B) and hyaluronic acid had no effect. Those polyanions which accelerated precipitation reduced fibril width and those which retarded precipitation increased it. The accelerating effect of chondroitin sulfate A increased with decreasing pH in the range pH 6-8 and with increasing *I* in the range 0.13-0.31. ***G. C. Wood.*** *Biochemical Journal*, v. 75, no. 3, June 1960, p. 605-612.

10957* Fundamentals of Molding Wood Particles. Molding a product from a mixture of wood particles and resin is a profitable way of utilizing wood residues, but certain variables, such as specific gravity, resin content, mesh size, molding pressure, and temperature, must be considered in relation to their influence on cure cycle, water absorption. ***Kenneth H. Brockschmidt.*** *Forest Products Journal*, v. 10, Apr. 1960, p. 179-183.

10958* Bark and Fiber Products for Oil Well Drilling. Wood products result in improved drilling muds. Quebracho, redwood and hemlock bark, pulp liquors, and other forest materials keep muds working, while sawdust, fibers, and cellophane conserve muds. ***R. W. Miller and W. G. Van Beckum.*** *Forest Products Journal*, v. 10, Apr. 1960, p. 193-195.

10959* Investigations of the Penetration of Concentrated Vegetable Tannin Solutions Into Pelt. The penetration speed of vegetable tannins into pelt not pretanned is determined by the diffusion potential, the viscosity of the extract, and the osmotic pressure which the tannin solution exerts on the pelt. By raising the temperature of tanning liquors of normal concentration it is possible to lower the viscosity considerably. (*In German.*) Unterschungen über das Eindringen konzentrierter vegetabilischer Gerbstofflösungen in Haut. ***E. Heidemann.*** *Leder*, v. 11, May 1960, p. 99-105.

10960* The Origin of the Pattern of the Lateral Band in Collagen. The investigation results show that the lateral band pattern of the native collagen fibrils originates in the superimposition of the lateral band pattern of long spacing segments. It is shown that the pattern of the lateral band reflects the order

of heavy and polar amino acids. (*In German.*) Uber den Ursprung des Querstreifungsmusters bei Kollagen. ***K. Kühn.*** *Leder*, v. 11, May 1960, p. 110-117.

10961 The Man-Made Fibres Industry. Processes, development, structure, prices, and costs of production, natural fibers and other competing materials, fiber properties and interfiber competition are discussed. ***R. Robson.*** 135 pp. 1958. St. Martin's Press, New York. (TS1548 R57m)

10962* Effect of Chip Damage on the Quality of Sulphite Paper Pulps. A method was developed for determination of the relative degree of damage in technical sulfite chips. The pulps obtained were beaten and their strength properties were tested. The bursting strength was found to be the most useful property for calculation of the relative degree of damage. ***Hanno Bausch and Nils Hartler.*** *Svensk Paperstidning*, v. 63, no. 9, May 15, 1960, p. 279-285.

10963* Effect of Cellulase on Cotton Fiber Microstructure. I. Degradation by Cellulase in Fungal Growth Filtrates. II. Degradation During Growth of Cellulolytic Microorganisms. Electron microscopical studies of changes in cotton fiber microstructure, after exposure of the fibers to the cellulase in filtrates prepared from cultures of *Myrothecium verrucaria*, showed evidence of the transverse, jagged cuts into the cellulose structure previously seen by optical microscopy. Measurements of changes in tensile strength, swelling in alkali, and in glucose yield were correlated with changes in microstructure. The extent of fiber degradation by cellulolytic culture filtrates was limited and could be continued only if fibers were swollen between filtrate exposures. No evidence of damage to the cellulose structure was seen which could not be explained by hydrolysis at the β-1,4-glucosidic linkage. Electron microscopical studies were made of changes in cotton fiber microstructure on samples from cultures of the bacterium *Cellvibrio fulvus* and the fungus *Myrothecium verrucaria*. Bacterial colonies, growing in the folds of the primary wall, caused diagonal or longitudinal splitting of the fiber surface. Degradation by the fungus was characterized by transverse cracks in the fiber wall. Cottons modified to produce a more expanded microstructure with higher amorphous cellulose content showed large decreases in resistance to microbial attack. Attack by growing microorganisms was more intense and rapid than degradation by growth filtrates obtained from cultures of cellulolytic fungi, but the mode of degradation was similar. ***Blanche R. Porter, Jarrell H. Carra, Verne W. Tripp, and Mary L. Rollins.*** *Textile Research Journal*, v. 30, Apr. 1960, p. 249-267.

See also: **9929** (paper drying).

WELDING AND JOINING

10964* Use of Ferrosilicon in the Coatings of Electrodes for Electric Arc Welding. A safe and rapid process for the protection of ferrosilicon against the alkalized water of soluble glass, based on the use of a tension active compound is proposed. The behavior of ferrosilicon in the presence of alkalized water is studied in the case when ferrosilicon has been prepared according to the classic process or according to the new process. Results are the same. (*In Rumanian.*) Utilizarea ferosiliciului in invelisurile electrozilor pentru sudarea cu arcul electric. ***T. Salagean and V. Getia.*** *Academia Republicii Populare Romine. Baza de Cercetări Ştiinţifice Timişoara, Studii şi Ceretări, Ştiintifice, Seria Ştiinte Chimice*, v. 6, nos. 1-2, Jan.-June 1959, p. 153-159.

10965* Effects of the Preliminary Heating of the Parts on the Process of Pressure Welding of Aluminum. The relationship between the specific pressure of the deposition and the temperature of the metal during butt pressure welding of Al was studied. A metallographic analysis of the butt-welds of Al confirmed that the degree of deformation, necessary for maximum welding strength, is independent from the preheating temperature. The pressure of deposition depends on the temperature of the metal when the parts are heated by means of an electric current. (*In Russian.*) Vliianie predvaritel'nogo podogreva detaleĭ na protsess pressovoĭ svarki aliuminiia. ***S. K. Sliozberg, I. M. Stroĭman, and S. O. Libo.*** *Avtomaticheskaia Svarka*, v. 13, no. 5, May 1960, p. 26-31.

10966* Cast Iron Electrode Strip. This type of strip has a variable thickness (0.7 - 1.0 mm) and structure (from ferritic to perlitic cast iron). Stable welding conditions are permitted by the regulating speed of the feed and the application of low silicide flux AN-28 with high stabilizing properties. The speed of melting different parts of the cast iron strip, electron strip, and various parts can be different; cast iron with homogeneous distribution of C melts more rapidly. The coefficient of deposition can vary between 10 and 15%. The structure of the metal deposited (chilled cast iron) is independent of the initial structure of the electrode strip. (*In Russian.*) Chugunnaia elektrodnaia lenta. ***G. V. Ksendzyk.*** *Avtomaticheskaia Svarka*, v. 13, no. 5, May 1960, p. 78-83.

10967 Droplet Transfer During Arc Welding in Various Shielding Gases. Briefly reviews some important investigations on droplet transfer in the arc welding of steel with a consumable bare wire, and discusses the results obtained from high-speed cinematography, particularly the remarkable droplet transfer in CO_2 with the wire connected to the positive pole. ***L. F. Defize and P. C. van der Willigen.*** *British Welding Journal*, v. 7, May 1960, p. 297-305.

10968 Electron Beam Welding. A versatile vacuum welding equipment using an electron bombardment heat source is described in relation to the factors that govern its design. The operation of this equipment is simple, and several of the welding techniques employed are discussed. ***M. E. Harper and E. G. Nunn.*** *British Welding Journal*, v. 7, May 1960, p. 331-336.

10969 Application of Electro-Slag Welding. The electroslag welding process is described and compared with other welding processes, particularly submerged-arc. It is shown that for most structures the mechanical properties of electro-slag weld metal are more than adequate if it is normalized after welding. ***A. M. Horsfield.*** *British Welding Journal*, v. 7, May 1960, p. 337-341.

10970 Semi-Automatic Welding With Fine Wires. Recent developments in equipment provide alternative methods of feeding fine wires down to 0.020 in. diam. for the welding of thin aluminum alloys, steel, stainless steel, and copper alloys. The development of slope-controlled power sources has greatly facilitated the welding of thin material and the positional welding of steel and stainless steel using dip transfer. ***R. V. Brimble, J. A. Lucey, and D. B. Tait.*** *British Welding Journal*, v. 7, May 1960, p. 342-352.

10971 Relationship Between Microstructure and Mechanical Properties of Mild Steel Weld Deposits. Optical and electron-microscope studies have been made of the structures of mild steel welds deposit by metal-arc, argonarc, atomic hydrogen, and oxyacetylene processes, to determine the relationship between structure and mechanical properties. ***K. J. Irvine and F. B. Pickering.*** *British Welding Journal*, v. 7, May 1960, p. 353-364.

10972 A Note on Recent Experience With the Rockweld-Vus Electro-Slag Welding Machine. Gives interesting applications of the Rockweld-Vus electro-slag welding machine and the results of the mechanical tests carried out on the preliminary welds. ***W. K. B. Marshall.*** *British Welding Journal*, v. 7, June 1960, p. 393-395.

10973 Spot Welding of Carbon Manganese Steel. By the use of a special post-heat tempering technique, which is carried out on the welding machine with appropriate electronic control equipment, welds with improved ductility and tensile strength can be produced. A recommended welding technique is described. ***C. Phillips.*** *British Welding Journal*, v. 7, June 1960, p. 396-410.

10974* The Welding and Brazing of Certain Cobalt-Containing Alloys. As corrosion- and heat-resistant materials, the Co-containing alloys resemble certain austenitic types of stainless steels. Processes and techniques applicable to the welding of the latter can also be used on the former after slight modification. Most brazing of parts for elevated-temperature service is done in purified, dry H. In general, the strength of joints of the alloys that are not readily brazed in H will be higher when vacuum brazed. ***W. J. Lepkowski and R. E. Monroe.*** *Cobalt*, no. 7, June 1960, p. 6-12.

10975 Ultrasonic Welding Equipment. What is believed to be the first fundamental study of the mechanisms involved in ultrasonic welding has been started. On the basis of observations made in this study, it is postulated that this new welding process is a form of pressure or friction welding, in which material surfaces subjected to a clamping force are welded when made to slide in contact with each other. The process appears to be related directly to the frictional phenomena of galling and seizing. The relationships between weld strength and the variables of clamping force, duration of weld cycle, ultrasonic motion, and temperature, have been obtained for a Monel sphere welded to a Cu plate. This work shows that there is a minimum displacement and temperature required for welding. Also, that weld strength is directly proportional to clamping force, displacement, weld time, and temperature, up to critical values of these variables. Under conditions where critical values are exceeded, weld strength is decreased, apparently because of fatigue about the weld zone. The minimum displacement required for welding agrees with displacements calculated to be necessary to produce sliding. On the basis of conditions found necessary to produce a weld, the problems encountered in designing welder components are discussed and methods of circumventing them are presented. ***John N. Antonevich.*** *IRE Transactions on Ultrasonics Engineering*, v. UE-7, no. 1, Feb. 1960, p. 26-32. (TK1 In6.6u Vis.)

10976 New Developments in Metals-Joining Processes. Covers improvements and different processes that have been introduced to general use since 1956. Electroslag, electron-beam, arc-spot, high-frequency, foil-seam, magnetic-force, ultrasonic, friction, and explosive welding methods, and high-temperature brazing and diffusion bonding are discussed in detail. ***P. J. Rieppel.*** *Machine Design*, v. 32, June 9, 1960, p. 189 + 5 pages.

10977 How to Choose the Right Solder Flux. The old classifications of "corrosive" and "noncorrosive" fluxes are no longer adequate for today's soldering needs. Here's an up-to-date flux selection guide, based on chemical origin, and covering all the significant types. ***Howard H. Manko.*** *Product Engineering*, v. 31, no. 24, June 13, 1960, p. 43-50.

10978* Some Metallurgical Aspects of High-Thickness Steel Welding. Discusses selection and characteristics of the welding method; brittle fracture of thick materials; dispersion of the strength values in welds; defects due to the metal or to the weld, such as hot and cold cracks, microfissures, porosity and non-metallic inclusions; non-destructive detection of defects; and use of new methods such as the Russian process of automatic welding under molten flux. (*In French.*) Quelques aspects métallurgiques du soudage des fortes épaisseurs en acier. ***Jean Sebille.*** *Revue de la Soudure*, v. 16, no. 2, June 1960, p. 55-101.

10979 The Science of Arc Welding. Evaluation of the present knowledge provides the engineer and the research man with basic concepts of volt-ampere relationship, distribution of field intensities and temperatures, metal transfer, spatter, arc forces and motion, melting rate, weld area. ***Clarence E. Jackson.*** *Welding Journal*, v. 39, June 1960, p. 225s-230s.

10980 Weld Metals in Nickel-Base Alloys. Laboratory investigation indicates that sound welds in these alloys tend to have good strength, ductility and toughness at normal and low temperatures. Best results are secured from Ar-shielded Ni-Cr-Fe-Cb type welds. ***J. Heuschkel.*** *Welding Journal*, v. 39, June 1960, p. 236s-246s.

10981 Resistance Seam Welding of Terne Plate. The changes in welding variables necessary for seam welding terne plate are described, and the welds produced are compared with welds having a Zn coating. ***Horace F. Greer and M. L. Begeman.*** *Welding Journal*, v. 39, June 1960, p. 247s-254s.

10982 Arc Welding of 5% Cr-0.5% Mo Alloy-Steel Pipe. Wide use of low-chromium-molybdenum steels in the petroleum industry prompted a study on properties of weldments of these steels. ***J. Bland and G. F. Tisinai.*** *Welding Journal*, v. 39, June 1960, p. 255s-265s.

10983 Submerged-Arc Welding HY-80 Steel. A study was made to develop methods for making submerged-arc welds capable of withstanding severe impact loading at low temperatures. Increasing Ni content lowered weld-metal notch toughness, especially at testing temperatures above −40 F. However, at testing temperatures below −40 F, increased Ni appeared to be beneficial. Increasing Mn content also lowered weld-metal notch toughness at testing temperatures above −40 F, but at testing temperatures below −40 F, the notch toughness of the welds was about the same. Increasing Mo content generally lowered weld-metal notch toughness. ***W. J. Lewis, G. E. Faulkner, D. C. Martin, and P. J. Rieppel.*** *Welding Journal*, v. 39, June 1960, p. 266s-272s.

10984 Micro-Wire Welding. The micro-wire process should prove most valuable to the welding industry, particularly in the sheet-metal field and in overcoming poor joint fit-up or excessive joint gaps. It will be most widely used on metals ranging from 24 gage to ¼-in. thickness. ***Harley J. Orr and John H. Headapohl.*** *Welding Journal*, v. 39, June 1960, p. 600-605.

See also: **10615** (fatigue strength of welded plates); **10707** (radiographic weld inspection); **10708** (magnetographic weld inspection); **10710** (ultrasonic weld inspection).

MISCELLANEOUS

10985* Certain Methods for the Effective Application of the Linearization Principle to the Construction of Solutions of an Important Class of Problems of Non-Linear Chebyshev Approximation. The methods proposed in this paper, in distinction to the general approach in the author's previous note, are characterized by a more limited application of the principle of approximate linearization, the precise nonlinear statement of the problem being kept more directly in view (at any given stage). (*In Ukrainian.*) Deyaki sposoby efektyvnogo zastosuvannya pryntsypri linearyzatsiyi du pobudovy rozv'yazkiv pevnogo vazhlivogo klasu zadach neliniĭnogo chebyshovs'kogo nablyzhennya. ***E. J. Remez.*** *Akademiia Nauk Ukrains'koĭ RSR, Dopovidi*, 1960, no. 3, p. 272-278.

10986* On a Geometrical Locus of Points in a Hyperbolic Plane. The following question is considered in this paper: a fixation straight line and a bundle of straight lines l with center M are given in a Lobachevsky plane; find by geometrical means the locus described by the point of intersection of the line l with the common perpendicular of the straight lines ζ and l. Proves that the geometrical locus, depending on the relative positions of point M and line ζ, will be one of the followinlg lines: a semi-hyperbola, a concave hyperbolic parabola with two branches, a concave hyperbola, a convex hyperbola, a straight line. (*In Ukrainian.*) Pro odne geometrichne mistse tochok v giperbolichniĭ ploshchyni. ***M. G. Andrievskaya.*** *Akademiia Nauk Ukrains'koĭ RSR, Dopovidi*, 1960, no. 3, p. 285-288.

10987* On the Asymptotic Solution of Integro-Differential Equations With Slowly Changing Coefficients. Presents the asymptotic solution of an integro-differential equation in two cases: in the "resonance" case and in the "non-resonance" case. (*In Ukrainian.*) Pro asymptotychne predstavlennya rozv'yazkiv integro-dyferentsial'nykh rivnyan' z povil'no zminnymy koefitsiyentamy. ***I. I. Markush.*** *Akademiia Nauk Urkains'koĭ RSR, Dopovidi*, 1960, no. 3, p. 294-299.

10988* Solution of Boundary Problems for a Class of Ordinary Differential Equations by the Method of Finite Differences. Considers the question of the solution of a boundary problem employing the method of finite differences. Replacing the differential expressions by difference expressions is proposed. Conditions are established guaranteeing the solvability of the resulting difference equation and the convergence of its solution towards the exact solution of the problem. (*In Ukrainian.*) Rozv'yazuvannya kraĭovykh zadach dlya odnogo klasu zvychaĭnykh diferentsial'nykh rivnyan' metodom skinchennykh riznyts'. ***P. S. Bondarenko.*** *Akademiia Nauk Ukrains'koĭ RSR, Dopovidi*, 1960, no. 3, p. 300-304.

10989 American Society for Testing Materials, Proceedings, 1959. v. LIX. 1412 pp. 1960. American Society for Testing Materials, Philadelphia. (TA401 Am35p Vis.)